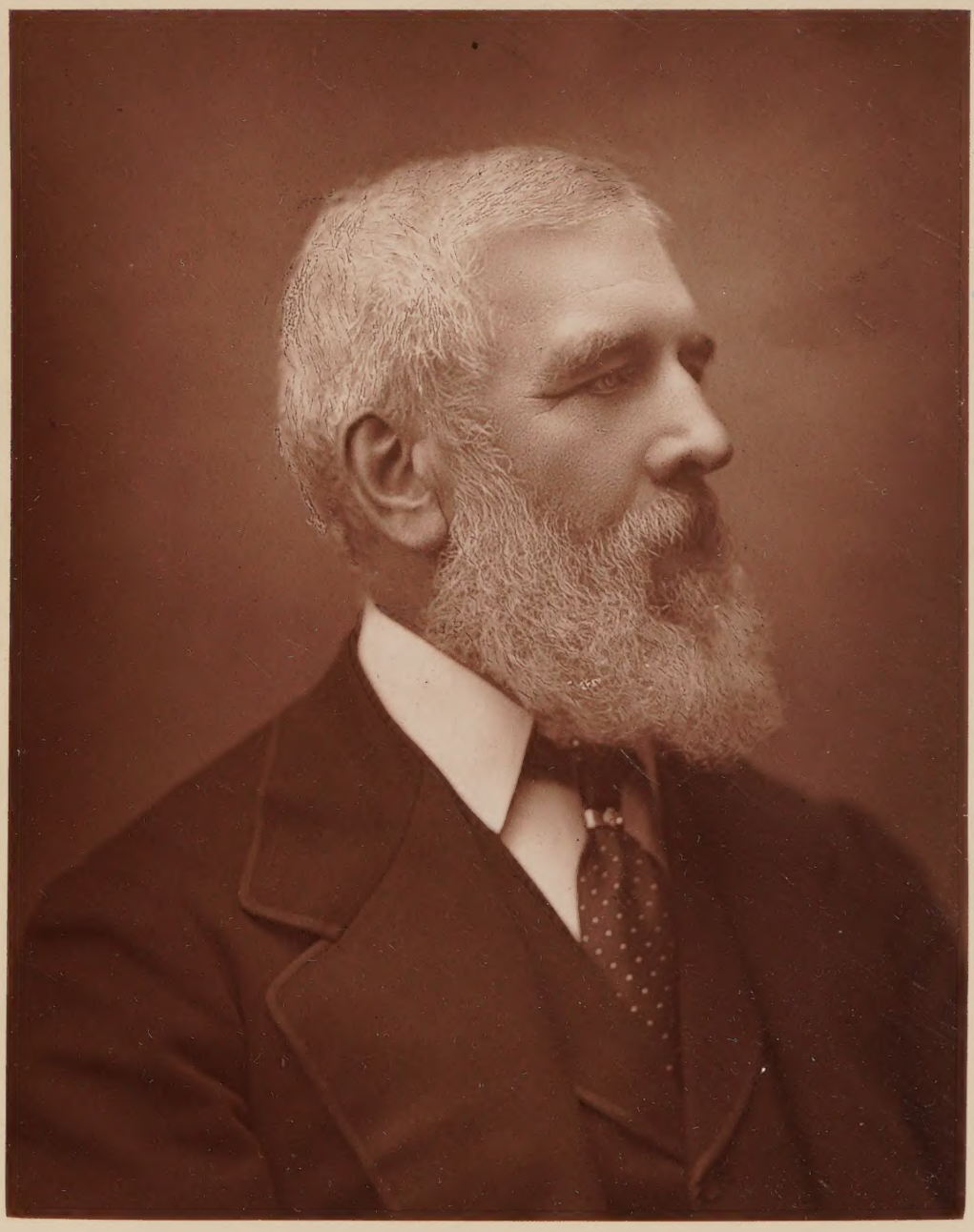
TRANSACTIONS

OF THE

Odontological Society of Great Britain.

VOL. XVIII.—NEW SERIES.



H. R. Barraud, Photo. *Woodburytype.*

HENRY JOHN BARRETT, M.R.C.S., Eng., L.D.S., Eng.

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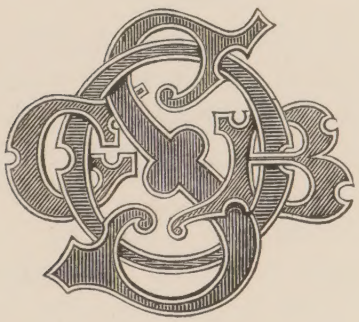

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HARRISON AND SONS,
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Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

November 2nd, 1885.

MR. CHARTERS WHITE, M.R.C.S. AND L.D.S.ENG.,
VICE-PRESIDENT, IN THE CHAIR.

THE Minutes of the last meeting having been confirmed,

MR. ARNOLD ROGERS rose and requested permission from the President to say a few words before the regular business of the evening commenced. He would be as brief as possible, since there was always a good deal to be done at the first meeting of the Society after the recess. In a very few days the Society would enter upon its thirtieth year, a term usually regarded as coinciding with a generation of the human race. Of the eighteen founders of the Society, nine—one-half—had passed away; and considering that some of them were at that time—thirty years ago—men of mature age—he believed he was almost, if not quite, the youngest—it was, he thought, a fair record that so many were still living. Nay, more, some of them were not only alive, but "kicking," and were still, as of yore, giving their time and energies to the service of the profession in its various developments. Of these workers there was one to whom they were all very deeply indebted, not merely as members of that Society, but in every department of professional work. One who, in his quiet, unobtrusive way, had rendered them priceless services; who united practical business habits with courtesy and tact, the most generous temper with the most outspoken candour, a very firm will with the most considerate and thoughtful kindness;

whose genial nature reconciled enemies, and united friends still more closely; whose character, absolutely truthful and honourable, so completely commanded the confidence of the profession, that he had all its public property entrusted to his guardianship; who seemed, in a word, to have been specially endowed for the duties which he so ably and kindly discharged.

A few of the Treasurer's oldest friends, who had had the best opportunities of knowing his worth, thought the Society would be pleased to see his portrait in its meeting room. It was, indeed, to be hoped that Mr. Parkinson himself would continue to occupy his present position for many a year. But the time would come when, as he and the other elders of the Society hoped, their successors would reign there, and might perhaps look with some interest on the "counterfeit presentments" of those who, during the latter half of this century, devoted themselves, their time, and their energies to the duty of promoting the highest interests of their profession; and he felt sure that tradition would hand down some very lovable memories in connection with the name of James Parkinson.

On behalf of those who had joined in this labour of love, he would beg the Society's acceptance of its Treasurer's portrait, and request that it might be given a "local habitation" in the place where he had done so much good work and true.

The PRESIDENT replied that after the eloquent manner in which Mr. Rogers had discharged his duty, it would be unnecessary for him to say more than that he felt convinced that every member of the Society would fully endorse the eulogy which Mr. Rogers had pronounced. He gratefully accepted, on behalf of the Society, the valuable present which was offered to it, and which would be prized by the younger members and their successors as long as the Society existed.

The PRESIDENT then announced that Mr. R. L. Markham, L.D.S.I., of 19, Eldon Square, Newcastle-on-Tyne, had been

duly nominated as a candidate for membership, and would be balloted for at a subsequent meeting.

Mr. Weiss reported that the following works had been received for the Library either as donations or exchanges, viz. :—

Manuel de Chirurgie et de Pathologie Dentaires, par Alfred Coleman.
Proceedings of the Royal Society.
Journal of Anatomy and Physiology.
Quarterly Journal of Microscopical Science.
Proceedings of the Royal Institution.
Correspondenz Blatt für Zahnarzte.
Transactions of the New York Odontological Society.
Year-Book of Scientific and Learned Societies, &c.

There had also been added to the Library by purchase fourteen additional German works, some of which were rare, and all of more or less interest. He was glad to be able to state that the German portion of the Library was now more complete than he had at one time expected to get it.

1. Albrect, Klinik der Mundkrankheiten; Erster Bericht, 1855–1860; Berlin, 1862.
2. Ditto, Ditto; Zweiter Heft; Die Odontome; Die üblen Zufälle bei Zahnextractionen; Berlin, 1872.
3. Mitscherlich, Replantation und Transplantation der Zähne. Reprinted from Langenbeck's Archiv., Vol. IV.
4. Bruck, Die Galvanokaustik in der Zahnarzte Praxis; Leipzig, 1864.
5. Faber, Die Cysten welche mit den Alveolen der Zähne in Verbindung stehen; Tübingen, 1867.
6. Tappert; De Ossium Regeneratione Nonnulla, adjecto Casu Singulari Regeneratæ Mandibulæ; Berlin, 1831.
7. May, De Evolutione Dentium Humanorum; Berlin, 1833.
8. Gallette, Anatomische, Physiologische und Chirurgische Betrachtungen über die Zähne; Mainz, 1813.

9. Lang, Uber das Vorkommen von Zähnen im Sinus Maxillaris; Tübingen, 1844.
10. La Forgue, Die Zahnarzneikunst mit Anmerkungen und Zusätzen von Angernrame, aus dem Französischen; Leipsig, 1803; 2 Theile in 1 Band, mit 18 Kupfertafeln.
11. Köcker, Grundsätze der Zahnchirurgie, aus dem Englischen; Weimar, 1828.
12. Hensinger, System der Histologie; 1 Theil Histographie; 2 Heft Bildungsgewebe, Horngewebe; Eisenach, 1823.
13. Kölliker, Microskopische Anatomie oder Gewebelehre des Menschen; 2 Band, Spezielle Gewebelehre; 1 Hälfte, Leipzig, 1850; 2 Hälfte Leipzig, 1854.
14. Der Zahnarzt, eine Zahnärztliche Zeitschrift. Complete 27 Jahrgänze von 1846–1872.

The CURATOR said that the only addition to the Museum which he had to show was a model which had been sent by Mr. Charters White, and as the donor was present perhaps he would not mind describing it.

MR. CHARTERS WHITE said the model represented the upper jaw of a young man, aged twenty-four, and showed a supernumerary central and a supernumerary canine. Besides the overcrowding, it would be seen that the mouth was in a very neglected condition, but the patient would not allow anything to be done.

MR. STORER BENNETT read the following communications from Mr. C. W. Dunn, of Florence:—

(I) "A girl about thirteen years of age presented herself at the Dispensary for the Treatment of Teeth, and requested that the right lower central incisor should be extracted.

"All the permanent teeth, with the exception of the wisdom teeth, were present and in good condition; the tooth to which she pointed seemed discoloured, malplaced, very much out of the proper line, and was exceedingly loose, hanging, as the saying is, by a thread. At the first moment I thought that it was the deciduous tooth which had remained beyond its

proper time; but on touching it with a pointed excavating instrument it fell out, and great was my surprise to find that it was a permanent tooth, that it was bent at a considerable angle, and that in this angle there was a miniature tooth, attached by its extremity to the peridental membrane of the bent tooth. I observed no abnormal appearance of the parts around; the gum seemed full, round, and it appeared to me as if the tooth had loosened from periostitis. Evidently, at some previous period, the tooth had been fractured transversely about the margin of the gum, and the two parts had re-united.

"The girl had left the Dispensary before I had remarked any of these peculiarities about the tooth, and therefore I could ask her no particulars with regard to when the injury had occurred, how much time had passed between the injury and the extraction of the tooth. I imagine from the appearance of the tooth itself, and from that of the parts around it, that some years must have elapsed.

"I have thought that it might interest some members to examine the section of the fractured tooth, and that of the small one, which might be called a parasitical tooth.

"I would ask what explanation can be given as to the formation of this smaller one? How it was produced, and by what?

"It will be seen that, although so small, it is perfect in all its parts, possessing its cementum, dentine, pulp cavity, and enamel (if I am not mistaken), and also that its enamel has a fracture in it. I would ask also those who are more competent than I, and who have more familiarity with the microscope, how and with what substance the fractured parts of the larger tooth have been united? Is it real dentine, is it cementum, or is it a production of the peridental membrane not possessing the exact character of either one or the other of those parts?

(II) "At the Dispensary for the Treatment of the Teeth of the Poor, in this city, in the past year, a woman brought a little child, whose lip was lacerated and swollen, the gum inflamed, and the right upper deciduous incisor missing. The history of the case was that the day before, the child, a little girl of

three-and-a-half years old, while playing in the house had fallen over a pail, and on being raised it was found after the bleeding had ceased, that the right upper incisor was no longer there, and on search being made for it, it was found entire, uninjured; at the extremity of its root was a large opening through which the pulp had passed, but there were no remains of the pulp in the tooth.

"The mother called attention to a substance hanging down between the remaining central and lateral incisors. It was shorter than the teeth, appeared to be a prolongation of the gum, was highly sensitive to the touch, and had the form of the missing tooth, being square at its lowest and free end. From its large size I thought at first that it was a part of the gum, which, having been lacerated, was hanging loosely down; but finding it so sensitive, and it having so completely the form of a tooth, I suspected that it might be the pulp which had remained, and that the bony outer casing of the tooth had just simply been slipped from it, as if it had been a skin or rind which had been forcibly dragged off.

"I called the attention of the students to it, and with their help drew it down as far as I could, cut it off as near to the gum as possible, and cauterised the exposed surface with a minute quantity of strong nitric acid.

"I took the excised portion to Professor Brigidi, and begged him to examine it, and ascertain whether it was the pulp or gum. He has made several preparations of it, which I forward for inspection, and would request that an opinion should be given.

"Professor Brigidi believes that it was the pulp, but not having experience in this particular branch of study, would be glad that others should determine the question."

Mr. S. J. Hutchinson related the following interesting case of reflex nervous disturbance caused by dental irritation.

In the course of the discussion on Mr. Power's paper on "The Relations between Dental Lesions and Diseases of the Eye," read before the Society two years ago, he had

mentioned the case of a lady* who had been sent to him by Dr. Gowers with a request that he would examine her teeth, and see if he could discover any probable cause for a spasm of the left eyelid from which she had suffered for some time. The patient's left eyelid was drawn up by a constant spasmodic contraction of the levator palpebræ in such a manner that not only the whole of the iris, but also a considerable amount of the white round it, was always visible. On examining the patient's mouth Mr. Hutchinson found her teeth in a very bad state. Both wisdom teeth on the left side were carious; the upper second molar on the same side was decayed, with an exposed pulp, and the lower second molar was in the same condition. Mr. Hutchinson extracted these four teeth, but though the patient no longer suffered from neuralgia as she had before, the spasm of the eyelid was not in the least diminished. There did not appear to be anything amiss with the other teeth; the left upper first molar contained a large Sullivan's stopping, but it had never given the patient any inconvenience, and she refused to allow it to be interfered with. Soon afterwards the patient returned to her home in the country, and Mr. Hutchinson saw nothing of her for more than a year. When she again presented herself the eye was in the same condition, and Mr. Hutchinson again failed to find anything in the mouth likely to be a source of irritation except the amalgam stopping in the left upper second molar. After some persuasion the patient allowed Mr. Hutchinson to remove this, and he then found at one spot a minute exposure of the pulp on which the filling had evidently pressed. Mr. Hutchinson thought it best to advise the removal of the tooth, and the result was most satisfactory. The patient's appearance at once began to improve, and at the end of six months, although on close examination a difference could still be discovered, it was so slight that it would not be noticed by a casual observer. It was evident, therefore, that in this case reflex irritation of the third nerve

* Vol. XVI, New Series, p. 73.

had been caused by irritation of a branch of the fifth, and this in the absence of any symptoms referable to the tooth.

The PRESIDENT remarked that such cases were often very misleading, and always difficult to deal with. He congratulated Mr. Hutchinson on his success.

MR. HEPBURN showed, for Mr. Arthur Underwood, a temporary upper molar with a large sequestrum attached which had been removed at the Dental Hospital from the mouth of a boy between five and six years of age; it was ascertained that he had suffered from measles about six months previously. Mr. Underwood had met with a precisely similar case in the course of his practice at the West London Hospital, and he wished to know whether other members had met with the same experience, and whether necrosis of the alveolus was a commoner sequel of measles than it had generally been supposed to be.

MR. STORER BENNETT showed a small gold medallion which had been produced by the Rotation Method and which had been sent to him by Dr. Herbst. It demonstrated very clearly the exceedingly accurate adaptation of the gold to the walls of a filling which was obtained by the centrifugal action of the rotating burnisher. A die or seal had apparently been used, and every line on it, down to the finest markings, were distinctly reproduced on the gold. It only occupied five minutes in doing.

He also exhibited the instruments now used by Dr. Herbst in filling by the rotation method. In order to avoid the loss of time caused by the frequent changing of the engine attachments, Dr. Herbst now used smooth, round hand-burnishers for the first packing of the gold, afterwards condensing it thoroughly by means of the rapidly revolving "roof-formed" instrument attached to the engine.

Mr. Bennett next handed round some shields invented by Dr. Herbst for the purpose of protecting the cheek and tongue when using sand-paper discs. Also some bloodstone points, of German manufacture, which he (Mr. Bennett) had found to answer better than any other material he had

yet used. They were, however, only available for largish cavities.

When filling interstitial cavities in front teeth Dr. Herbst passed a thin piece of steel between the teeth, and bent the free end towards the opposite cheek. Thus if a mesial cavity existed in a right upper lateral incisor, the steel would be passed between this tooth and the central, its free end being bent towards the left cheek, where it would be retained by the left hand. Similarly, should the cavity exist in the distal side of the same tooth, the steel being introduced between the lateral and canine, its free end would be pressed over towards the right cheek. An inclined plane would thus be formed leading directly to the cavity, into which the gold could be introduced from the front of the teeth with great facility. Mr. Bennett added that he had tried to describe this at the meeting of the Association at Cambridge, but he feared it had not been correctly understood. He therefore demonstrated it again.

The PRESIDENT thanked Mr. Bennett for his explanation, and said the filling shown was really a remarkable specimen, and one which testified most thoroughly to the capabilities of this process in the filling of any cavity, however irregular in shape.

He then called upon Mr. Balkwill for his paper.

A Method of Mounting Porcelain Crowns on Pulpless Molar Roots.

By F. H. Balkwill.

Mr. President and Gentlemen,

The antiseptic practice of treating pulpless teeth for filling has given us confidence in retaining pulpless roots. To utilize these for the support of a crown has been successfully performed by several methods, the best of which is a hollow crown of gold plate made so as to closely clasp any available portion of the natural tooth. But while the Richmond crown is very efficient, it requires so much skill and time for its application that it must always be an exceptional operation.

In the crown which will be brought before you to-night the object has been to produce a plan comparatively easy.

Two principal difficulties are met with: first, the size, shape, and position of the roots of molar teeth forbid the use of stiff pivot wire to fix the crown. Secondly, as a fixed pin cannot be used, the crown must be in the form of a cap to hold a cement which is to retain and support it when hard; the difficulty is to keep the crown in place until the cement hardens.

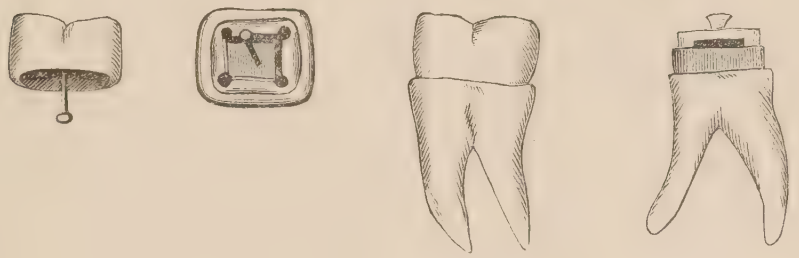
Messrs. T. Lemale and Sons have produced a crown from my designs which meets these difficulties with some success. It is of porcelain, about the size and depth of an average natural crown; hollow, so that when placed upon a root, it rests upon a thin margin; in the middle of this hollow, under the centre of the crown, is a second smaller chamber much undercut, to act as a cavity of retention. At the four corners of this cavity are four little cornices to strengthen the neck of the cement when packed in the cavity, by forming struts or buttresses. In the centre of the retaining cavity a thin, headed platina pin is fixed, which protrudes sufficiently from the under surface of the crown when in place to reach to the bottom, or near it, of the pulp cavity in the natural root.

It is applied in the following manner:—

The root canals having been first treated and filled, and the margins dressed down with a flat file, level with the gum, the general surface of the root is ground concave with the burring engine. A model is now taken and sent into the workroom to be poured, and whilst this is being done, the operator proceeds to form the pulp cavity into a retaining chamber of as nearly as possible the same form as that in the porcelain crown. If the roots are large and advantageously placed, smaller retaining pits are drilled a short distance into

them. A crown is now fitted on the model in the workroom, and readjusted in the mouth until it fits, root and bite. Should the platina pin be too long, it may be bent up a little or cut short and a fresh head of soft solder attached. Some Stewart's Sullivan's cement is now thoroughly well levigated, first in dilute sulphuric acid, and then in water for several minutes until it becomes very plastic; this is divided into two portions, one of which is wrung in a napkin as dry of mercury as possible. The crown is then taken in the hand and some of the more plastic portion is well packed with suitable pluggers to fill the retaining cavity. The hollow of the crown is now to be filled with the drier portion, being well tamped around the pin to unite it with that first put in; it is then packed up to the top of the pin and smoothed off so as to leave it in the form of a cone or pyramid. The cavity in the root, having been well washed and dried, is next filled with the plastic portion of cement, and then with a straight instrument a conical pit or depression is scooped in it to receive the cone of cement in the crown; this is now put in and pressed in place, with a slightly oscillating, rotating motion, after which the patient is directed to bite it into place; the overflow is cleared away and the patient dismissed with a caution to regard the tooth until the next day as if it had a newly exposed nerve.

A weak point in this paper is that the crowns have not been worn long enough to give them a fair trial, the reason being that Messrs. Lemale promised not to put them before the profession until I had described them; but I think the properties of the materials used are sufficiently well known to make a trial of the crown worth consideration.



I now hand round for your inspection—first, one of the crowns as received from Messrs. Lemale; secondly, a root prepared to receive it; thirdly, a root with the crown attached; fourthly, a root to which a crown has been attached and broken off, leaving the cement as nearly intact as possible, for you to judge of its liability to fail from caries or weakness of joint.

I have used ten teeth in the following seven cases:—

Case 1.—Miss G——n, age 22. Right second lower molar.

May 13th, root prepared.

July 8th, crown fitted.

(*Model shown.*)

Case 2.—Mr. W——n, age 16. Right second lower molar, left first and second lower molars.

September 11th, roots prepared.

September 22nd, crowns fitted.

This case (No. 2) is an advantageous example of the use of such crowns, the boy having lost most of his masticating power, yet the roots being firm and strong with articulating upper teeth; his mastication is by this means restored in great measure, without the burden of wearing a plate. It also illustrates how close a bite can be made with this crown.

(*Model No.* 2 *shown.*)

Case 3.—Miss L——y, age 19. Right first lower molar.

September 22nd, root prepared.

September 26th, crown fitted.

September 28th, crown loose, having been bitten upon the day it was put in.

October 3rd, removed the crown, in which nearly all the cement came away, showing fracture at the neck in the cavity of the root. Reshaped cavity in the root and fixed a new crown.

October 14th, tooth all right.

This was the only case in which I have had a crown moved.

(*Model No.* 3 *shown.*)

Case 4.—Miss W——e, age 25. First right upper molar.

October 9th, root prepared and crown fitted at one sitting, the pulp canals having been previously prepared and filled.

October 14th, tooth firm, could eat well with it.

(*Model No.* 4 *shown.*)

Case 5.—Captain M——r, age 30. First right upper molar, masticating surface and mesial wall broken down, distal wall standing.

October 8th, prepared pulp canals.

October 13th, reduced natural crown diagonally from masticating surface of distal wall, to mesial cervical margin. Fitted porcelain crown by grinding diagonally to make up

deficiency, and fixed it. Seen since, it is firm and useful. It seemed advantageous to restore contour in this case, rather than leave a diagonal surface, almost sure to incommode by allowing lodgement of food. Unfortunately I omitted to take models of this case.

Case 6.—Mrs. C——r. Right upper molar, outer wall of crown alone standing.

October 20th, prepared pulp canals.

October 23rd, fitted partial crown.

October 30th, crown quite firm and comfortable, allowing clasp of artificial plate to grasp it.

(*Model No. 5 shown.*)

Case 7.—Miss H——n, age 19. First lower molars right and left.

October 20th, applied arsenic to pulps.

October 23rd, fitted crowns. This model is noticeable from the fact of there being a supernumerary tooth between first and second molars on each side.

(*Model No. 6 shown.*)

Discussion.

The President remarked that the paper was both interesting and practical, and he had no doubt that many of those present would have something to say on the subject of artificial crowns. He thought, however, that the majority of practitioners would scarcely agree with Mr. Balkwill in considering his method easy of execution. It appeared to him (the President) to be one which called for a considerable amount of care and neatness of manipulation.

Mr. Walter Coffin said the great difficulty with hollow porcelain crowns, especially when setting them with a material of the peculiar nature of amalgam, consisted in getting just the right amount of plastic material—neither excess or deficiency; and he thought that when the crown was intended to be fitted with any accuracy to the root, and no provision was made for the escape of surplus matter, this difficulty was almost insurmountable. He had mounted with some success, as no doubt others had done, many forms of porcelain teeth on molar and bicuspid roots, and more especially a pattern of molar with an undercut groove on the under side, originally designed in America for shallow bites in cast metal base or vulcanite work. As, however, this tooth had the defect of frequently splitting across where weakened by the groove, his father had, many years ago, made a modification in which one or two platinum pins, transversely placed, bridged the groove, and made a strong and tenacious crowning or plastic plate tooth. Placed with the groove post-anteriorly, the two open ends treated and finished as approximal fillings, a very sightly firm crown resulted.

Dr. St. George Elliott said he should have been glad if Mr. Balkwill had illustrated his description by means of a diagram. During his recent visit to America he had seen some crowns, exhibited by the S.S. White Company, which

closely resembled those shown by Mr. Balkwill. Personally he had had so much trouble with porcelain crowns for molars that he had almost entirely abandoned their use. He found that a better plan was to fit a gold or platinum band round the top of the stump, and fill this with amalgam: the result was, no doubt, somewhat unsightly, but it was useful.

Mr. J. S. Turner remarked that the great disideratum in fitting crowns was *space*. Given a sufficiency of space there was no difficulty, but without it it was impossible to use a crown of sufficient strength, and he knew of no method which could be employed successfully except that mentioned by Dr. Elliott. He had found one of Ash's ordinary vulcanite teeth answer the purpose admirably in some cases.

The President said the method appeared in Mr. Balkwill's hands to give very satisfactory results, but it seemed to him that it required very accurate judgment. Was there sufficient thickness of crown to allow of grinding to adjust the articulation?

Mr. Balkwill replied that there was really no difficulty in placing the crown in position. The pin projected a good bit beyond the hollow part of the crown; this was surrounded by rather dry amalgam, whilst the hollow part was filled with soft plastic amalgam, and when the crown was pressed into position the latter was forced out. He claimed that his crown could be fitted in cases where no other with which he was acquainted would serve. He would ask Mr. Turner to examine the models of Case 2; no tooth made by Messrs. Ash would be of the slightest use in that case. With regard to articulating, the crown could easily be let down by grinding the margin; it was not necessary to grind the top much.

The President then called upon Mr. Hern to read his paper on "A Method of Treating Dead Teeth."

A Method of Treatment of Dead Teeth.

By William Hern, M.R.C.S., L.D.S.Eng.

Mr. President and Gentlemen,

When I decided to make the treatment of dead teeth the subject of a short paper before you this evening, I was not ignorant that a great deal has been written and very much has been said already on the subject, for one has merely to refer to the dental journals of the past, Transatlantic as well as English, to find that the treatment of dead teeth has been a subject which has constantly exercised the minds and consciences of dental practitioners. Some may, therefore, be inclined to consider it too threadbare and over-trodden to be worthy of further consideration. The fact, however, that so much attention has been directed to it in the past, coupled with the disagreeable present fact that scarcely a day passes with the busy practitioner without his being called upon to treat certain of these frequently occurring and troublesome members, shows it to be still a theme of considerable practical importance.

Seeing, then, the subject has such a practical bearing in its relation to us, as dental practitioners, I need not, I think, apologise for bringing it before you.

The method of treatment which I shall lay before you may differ but little, perhaps, in some of its details from that commonly practised by you, except, I imagine, in the *kind* of root-filling and the *method* of inserting it, so that I must ask for your leniency if I travel now and then on well-known thoroughfares and refer to familiar manipulative details.

One of the first questions that we naturally put to ourselves is, "How can I most surely, expeditiously, and permanently save a dead tooth?" I think the answer to this question will be included in that of a second, viz., What is the cause *par excellence* by which dead teeth are lost to their possessors? This, I think we shall all agree, is the result of inflammatory action, of a more or less severe character, of the peridental membrane originated and excited by the putrefactive changes of a dead pulp. I do not deny that a destructive periodontitis may originate from other causes, *e.g.*, by extension from other local inflammations, or even from constitutional states, but in the overwhelming majority of cases the suppurative periostitis, or abscess, which necessitates the loss of the tooth, is due to septic decomposition of the soft tissue of the pulp.

Granting, then, that this is the *origo mali*, our rational treatment, it seems to me, should comprise the *total extirpation* of the pulp, where prac-

ticable, substituting for the soft tissue a material which is not prone to decomposition, but rather antagonistic to it; and, in those cases where the total extirpation of the pulp is impracticable, the same lines of treatment would indicate the application of certain antiseptics to prevent putrefactive changes in the small portions of pulp we have been compelled to leave *in situ.* I regard, however, a tooth treated by the latter method as one of which the prognosis is less hopeful than in the case of one treated by the former, and that the chances of success with a given tooth decrease in probability in the ratio of the increase of the quantity of soft tissue unavoidably left in the root canals.

We naturally divide dead teeth into two classes, as differing somewhat in their treatment—

I. Those which are devitalized by ourselves, and in which the pulps as a whole are not in a septic state.

II. Those which have died natural deaths and have subsequently undergone decomposition so that the pulp canals are soaked with septic detritus.

The difference in the process of treatment of these two classes of teeth is, however, one of degree and not of kind, the latter requiring all the manipulation I am about to speak of as advisable for the former, together with a course of dressing

to render them *aseptic* and to cure fistulous canals which they may have developed.

In both classes, however, I regard the following as three important axioms and principles of treatment:—

I. The opening out of the crown of the tooth in a direct, or nearly direct, line with the long axis of the root.

II. The enlargement or "funnelling out" of the orifices of the canals at their coronal ends, or openings into the common pulp chamber.

III. The enlargement and opening up of each root canal throughout its whole length, if practicable, by means of flexible flame-headed drills.

I. The opening out of the crown may be accomplished either by enlarging the cavity of decay in the direction of the axis of the root, or, in cases where the carious cavity is situated altogether out of the direct line of the root or roots, by making a *second* opening through the crown. In incisors and canines with interstitial cavities the root canal can often be made freely accessible to our instruments by cutting the coronal third of the pulp cavity obliquely towards the cavity of decay. If the root canal cannot be reached and cleared in this way, it will be better to make a second small

opening through the centre of the lingual surface of the crown.

In molars, similarly, with small deeply situated distal cavities it is frequently necessary to make a second opening through the crown in order to treat the root canals with any degree of thoroughness and safety.

II. The enlargement and "funnelling out" of the orifices of the canals at their coronal extremities is also an item of no small importance, giving, as it does, a clearer view of the canals and increased working space for their manipulation; it also removes any secondary dentine which may be obstructing the orifices of the canals. A pointed fissure bur is one of the best instruments for performing this.

III. The enlargement and opening up of the root canals I regard as one of the most important aids to the successful and expeditious treatment of dead teeth. It results in at least a fourfold advantage:—

(*a*) By enlarging the calibre of the canals it enables the operator to remove more easily and surely the soft tissue contained in them. This end is, moreover, greatly facilitated by the rotating action of the bur itself, for any lingering portions of dead pulp are effectually and rapidly removed by its twisting action.

(*b*) It enables the operator to introduce his

antiseptic dressings with greater facility and better effect, inasmuch as they can be passed down to the terminations of the root canals, and so correct any septic influences there; this is all the more important when we consider that mischief always commences at the extremity of the root.

(*c*) It enables the operator with greater ease and surety to fill the root canals.

(*d*) It results in a considerable saving of time, both to patient and operator, for the cutting away and removal of the septic walls of the pulp canals in teeth, the pulps of which have undergone putrefaction, considerably reduces the number of dressings required for a given tooth, consequently visits are saved both to patient and operator.

This enlargement and opening out of the root canal is best performed by the engine, armed with flexible flame-headed drills, possessing rather a coarse spiral thread. The *Morey* and *Gates-Gliddon* drills are those best suited to this purpose—the pointed head of the drill guides the instrument along the canal and prevents any deviation from it, whilst the large spiral thread obviates clogging and returns all *débris*.

It is necessary to use these instruments with the

greatest possible gentleness, allowing gentle persuasion to displace all force, working them with an alternate action of cutting and withdrawal; this prevents the burying of the head and consequent liability to fracture (at the neck of the instrument), at the same time that it brings out the *débris*. It is well *before* using the flexible drill, and occasionally *during* the use, to test the depth and direction of the root canal operated on with a blunt pointed flexible broach.

The teeth are not all equally amenable to the process of treatment thus far described, and may, I think, be divided into two groups, in regard to the probable ease or difficulty of dealing with their root canals. Under the term *Easy* (or 1st group) I would include all the normally and commonly straight roots with single and approximately round or oval canals. Among these I place incisors, canines, lower bicuspids, upper second bicuspids, palatine roots of upper molars and posterior roots of lower molars, as those teeth or roots which can be manipulated with tolerable certainty.

Under the term *Difficult* (or 2nd group) I would include those roots which are commonly more or less curved, and which contain small and laterally compressed pulp canals, together with those teeth in which the roots are neither constant in number, direction, or position. Among these I place an-

terior roots of lower molars, buccal roots of upper molars, first upper bicuspids, wisdom teeth, and abnormalities, as those teeth or roots which are most difficult of manipulation,—indeed in some, as I have before hinted, it is impossible, on account of the direction or position of the canals, to remove all the soft tissue,—consequently the probabilities of success in treatment are less strongly marked than with the former. In treating the anterior roots of lower molars we should not forget the very frequent and almost normal condition of a double canal.

With the canals opened and cleared as described, a recently devitalized tooth is ready for the root-filling. With septic roots, however, a course of dressing is first necessary to correct any lingering septic influences. The most reliable and efficient antiseptic for this purpose is, in my opinion and experience, *iodoform*, which can be used either dissolved in spirit or in conjunction with carbolic acid, glycerine, or eucalyptus, as a menstruum. I am at present unable to say whether mercuric perchloride will supersede iodoform as a root dressing, as I have not yet given it a sufficiently protracted trial to speak decidedly of its merits; it has, nevertheless, one prominent feature to its advantage in the absence of the pungent odour of iodoform, whilst it ranks very high as an antiseptic agent. I shall be glad, however, to know

what are the experiences of other members of the Society on this point.

All putrefactive manifestations having been combated by antiseptic dressings, our next concern is to fill the roots. A root-stopping should, I imagine, possess a variety of qualities and characteristics; among others it should be—

1. Antiseptic.
2. Non-irritating.
3. Easy of introduction.
4. Easy of removal.
5. Capable of perfect adaptation to walls of canal.
6. Soft and adaptable to a narrowing and deviating canal.
7. Solid at the body temperature.

These characteristics and qualities are, I think, combined in a root-stopping composed of wax and iodoform, which is introduced into the root canal while warm by means of a wisp of cotton-wool on a broach.

The details of this process are as follows:—The root canals, having been previously prepared for stopping, should be dried and slightly warmed by means of hot air from a syringe. A wisp of cotton-wool of a suitable size for the root canal is next rolled on an angular broach (being careful to roll the wool tightly on the point to ensure the broach propelling and not piercing it). This being ready,

a small piece of wax and iodoform may now be melted on a spatula, and whilst the wax is still hot dip the cotton wisp into it and immediately carry it to its place in the root canal by means of the broach, and press it into position with soft tempered canal pluggers. Care should be exercised in melting the wax not to overheat it and decompose the iodoform. About half the length of the root canal should be filled with the wax and iodoform, the rest may be completed with gutta-percha.

Wax may be easily charged with iodoform by melting it to a plastic consistency on a warm slab and then thoroughly impregnating it with about half its bulk of precipitated iodoform with a stiff spatula.

Such, gentlemen, is the *rationale* of the process which, in my opinion, ensures the greatest amount of permanent success in the preservation of dead teeth, and I shall hope, as the subject is such a practical one, that a good discussion may ensue, so that we may have the benefit of your views on the subject.

I may say, in conclusion, I am not laying myself open to the charge of advocating an untried remedy, inasmuch as I have used it with the best results for over two years.

Discussion.

The President said the question how best to preserve dead teeth in a useful condition was one which called for the best attention of every member of the profession. The more they studied conservative dentistry, and the more successful they became in the practice of it, the better they would please their patients, the majority of whom never applied for treatment till they were absolutely obliged, and then expected the dentist to make good the effects of their negligence. He should be glad to hear what those present had to say on the subject.

Mr. Latchmore said he could not agree with Mr. Hern in considering a mixture of iodoform and wax the best material for filling roots. He thought also that in Mr. Hern's method of introducing it, the broach with cotton wool round the point would be liable to act as a piston, and force *débris* through the apical foramen, where it would at once set up inflammation. In his opinion gold was a far better material to use. It was moderately easy to introduce, and also easy to extract.

Mr. Ackland said he had not used gold much for root-filling, but he had used the method described by Mr. Hern constantly for some time past, and had been very successful with it. He could fully endorse all that Mr. Hern had said in its favour.

Mr. Humby said the subject was one to which he had given a considerable amount of attention. He thought the wax and broach would act as a piston and force *débris* and air through the apex of the canal and thus set up fresh mischief. Mr. Hern had spoken of "dressings," but did not say how many were required. He found that he could treat such cases at one sitting. The essential points were to thoroughly get rid of the septic condition and remove all traces of moisture. His plan was to clean the canal carefully with cotton wool and spirits of wine, and then to inject cold air up the root for twenty minutes, until the tooth substances became white instead of slate-coloured; having thus got the canals

thoroughly dry, he proceeded to insert a permanent filling. He did not know whether Mr. Hern claimed any originality for his use of wax as a root-filling, but he (Mr. Humby) had certainly seen melted paraffine recommended for this purpose, he thought by an American dentist, two or three years ago.

Mr. S. J. Hutchinson said he believed Mr. Chas. Tomes had suggested the use of paraffine for root-filling in the Journal of the British Dental Association two or three years ago. He injected it into the canals by means of a hot syringe.

Mr. R. H. Woodhouse said he was very grateful to Mr. Hern for having prepared so good a paper at very short notice. He thought that most of Mr. Hern's observations and suggestions would be endorsed by those who had much experience of the operation referred to. For instance, his statement that its success chiefly depended on the extent to which the root canals could be cleaned and filled was quite in accordance with ordinary experience. The palatine roots of upper molars, which were easily filled, as a rule gave no trouble, whilst the buccal, which were not so easy, appeared also to require more treatment. He understood Mr. Hern to say that in certain cases he would cut away the crown of a molar for one-third of its extent in order to obtain better access to the root canals. He (Mr. Woodhouse) thought it was preferable to make a tap-hole in the centre of the crown; this did not impair the strength of the tooth, nor did it diminish its usefulness. The plan he usually adopted himself, after carefully cleaning the canals, was to pump in carbolic acid and phosphate of zinc, about 1 to 3, by means of a little cotton wool on a fine broach. He filled the canal with this for about half its extent, and the rest with gutta-percha, and had obtained very satisfactory results by this means. He supposed that Mr. Hern did not, as a rule, enlarge the canals except in the case of teeth with decomposed pulps.

Mr. Hern, in reply, said there could be no danger of forcing *débris* through the apical foramen, for he was always very careful to remove the whole of it, and get the canals quite clear before he attempted to fill them. As to the

danger of forcing the wax through the foramen, he would suggest that Mr. Latchmore should try a few experiments with teeth out of the mouth. He would then find that it was impossible to get the wax to pass the foramen unless the tooth was hot and the wax quite molten. Under ordinary circumstances, although it was introduced hot, it became plastic before it arrived at the apex of the canal. As to air being driven out before the filling, he did not think that a small quantity of air impregnated with iodoform was likely to do much harm, and as a matter of fact no harm did result. It appeared to him that gold was of all materials the most difficult to use as a root-filling, and the most difficult to remove if this should be called for. If drilled out, the operator scarcely knew whether he was penetrating the gold or the side of the canal. In reply to Mr. Humby, he thought that iodoform was more to be depended on as an antiseptic in these cases than carbolic acid; its effects seemed to be more permanent. The time required for treatment depended entirely upon the character of the tooth and the nature of the case. Mr. Humby must take a long time over his own cases, if he always followed out the lengthy process he had described. He (Mr. Hern) had not found it necessary to be so very particular about removing the last traces of moisture. He did not remember to have seen Mr. Chas. Tomes's paper on the use of paraffine for filling roots; he himself had treated dead teeth in the way he had described since November, 1883.

The PRESIDENT thanked Messrs. Balkwill and Hern for their papers, and said he hoped that the Society might be favoured with many more as useful and practical in the course of the session. He had also to thank Messrs. Storer Bennett, Hutchinson, and others for their communications.

At the next meeting (December 7th), Mr. Frederick Eve, the Curator of the College of Surgeons' Museum, would read the paper on "The Pathology of Cystic and Encysted Tumours of the Jaws," which had been postponed on account of Mr. Eve's numerous other engagements.

The Society then adjourned.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

December 7th, 1885.

C. SPENCE BATE, F.R.S., PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting having been read and confirmed,

MR. JAS. PARKINSON said he hoped the President would allow him to say a few words with reference to a matter which had just been referred to in the Minutes. He was deeply sensible of the honour which had been done him in placing his portrait in the Society's meeting room, an honour to which he did not consider that he had any special claim, and it was a great surprise to him when he received, a few months before, a note from Mr. Macartney asking him to sit for his portrait, and learned the purpose for which it was intended. He wished to take the opportunity of returning his thanks to those who had subscribed for the picture,—he could not thank them individually, for he did not know who they were,—and he thanked the Society also for having so kindly accepted it. As for the kind speeches which had been made on the occasion, he could only say that it had always given him great pleasure to meet his fellow-practitioners, and that he had striven to do his best for them and for the Society. He had certainly also lived among them for a good many years, and hoped he might remain for a few more.

Mr. R. Wentworth White signed the Obligation Book, and was formally admitted to membership by the President.

The President announced that the following gentlemen had been duly nominated as candidates for membership, and would be balloted for at a subsequent meeting:—

Messrs. Peyton Grenville Levason, L.D.S.Eng., 12, Bridge Street, Hereford;
J. Charles Storey, L.D.S.I., 9, Regent's Terrace, Anlaby Road, Hull;
Walter Harrison, L.D.S.Eng., D.M.D.Harvard, 98, Western Road, Brighton;
Morgan Hughes, L.D.S.Eng., 4, Wellesley Villas, Croydon; and
Henry John Kluht, L.D.S.Glasg., 44, Norfolk Terrace, Bayswater, W.

On the motion of the President, Messrs. Henri Weiss and Charles Truman were chosen to audit the Treasurer's accounts for the current year.

Mr. F. Weiss announced the following donations to the Library:—

Report of the Smithsonian Institute for 1883.
Quarterly Journal of Microscopical Science, November, 1885.
Proceedings of the Royal Society for June, 1885.
Calendar of the Royal College of Surgeons of England for 1885.
Diagnostik der Zahnkrankeiten von Dr. Josef Arkövy.
Notes on Anæsthetics, by Arthur S. Underwood.

Mr. S. J. Hutchinson said he had received from Mr. J. H. Mummery some photographic slides for the lantern representing some interesting specimens in Mr. Mummery's possession. They were very well executed, and Mr. Mummery had kindly promised to photograph some of the specimens in the Museum, and also to print some platina-types from them.

He had also received from Mr. Charters White two very

good photographs of the section of a reunited tooth, made through the line of fracture, which had been sent for exhibition by Mr. Dunn, of Florence, and shown at the last meeting.

From Mr. Cotterell he had received two models showing supplementary wisdom teeth in the upper jaw. He believed Mr. Cotterell had another specimen to exhibit, which perhaps he would describe himself.

Mr. Cotterell said the specimen he had to show was of interest as bearing upon a question raised at the last meeting. Mr. Hepburn then exhibited for Mr. A. Underwood an upper molar with a sequestrum attached, which had been removed from the jaw of a child who had a short time before suffered from measles, and, in a note which was read, Mr. Underwood mentioned another case of the same kind and asked whether they were common. In the course of the next week, he (Mr. Cotterell) met with a similar case at the Children's Hospital, Paddington Green. The child, aged three-and-a-half years, had suffered from measles six months before. Its mouth was, of course, in a very offensive state; the sequestrum was removed, and when brought again the following week the mouth appeared perfectly healthy.

Dr. St. George Elliott showed several contrivances which he had found useful. The first was an Electrical Indicator, in the form of a clock face, one hand being positive and the other negative. He had used this when testing the power of various forms of battery for use with the electric mallet, and by its means he could control any number of cells, increasing or diminishing the number in circuit at pleasure. Another was a small syringe, which during his recent visit to the States he had seen used by Dr. Dodge, of New York. It was made by removing the rubber cap of the S.S. White glass dropper, and substituting a cork piston with platinum piston rod and a platinum point.

The next was a hand-piece for the engine, which was simpler in its construction than any he knew of. The attachment was freed by merely pulling back a catch, and there

was no need of a cross-pin to keep the bar from rotating, as in the Hodge hand-piece.

Lastly, he showed a paper disc carrier, which he had rendered more efficient by increasing the length of the screw.

Dr. Geo. Cunningham described a plan of recording cases by means of cards which had just been adopted for use at the Edinburgh Dental Hospital. It was founded upon the "Proposed System of Dental Notation" which he had described in a pamphlet published two or three years ago, and which had been adopted by a good many practitioners for keeping records of cases treated in private practice. The Edinburgh cards had a diagram of the teeth, both upper and lower, printed in light blue ink, on which the nature of the operations performed could be graphically represented; below this were spaces for all necessary particulars respecting the patient, the treatment pursued, and its results. They were to be kept alphabetically arranged in drawers after the plan of the "card catalogues" in many public libraries. Lists of the symbols and contractions used were also printed on cards, one of which was hung near each operating chair, so as to be handy for reference. Dr. Cunningham handed round specimens of the cards filled up, and gave an outline of his system, pointing out the great value of such records both in hospital and in private practice, and said he hoped the example of the Edinburgh Hospital would soon be followed by other similar institutions.

Mr. Dennant said he thought it might be taken for granted that every practitioner would like to keep a record of his operations if he knew how to do it without any great expenditure of time and trouble. For some time past he had taken notes of all his cases according to Dr. Cunningham's system; he thoroughly appreciated its value and thanked its author most heartily for it. He used cards which were not quite as elaborate in their subdivisions as those which Dr. Cunningham had just shown, but which answered their purpose satisfactorily. When a new patient presented himself, he (Mr. Dennant) examined his mouth and noted its

condition on the diagram by putting a cross against any teeth which were absent, a horizontal line against those which had been replaced by artificial substitutes, and a tick against those which were carious. At each subsequent visit he filled in a record of work done, &c., and he kept the cards alphabetically arranged in pigeon-holes. He quite agreed with Dr. Cunningham as to the desirability of having one uniform system in general use if possible. It would be a great advantage to both patient and practitioner if, when a case changed hands, a record of work done and other important particulars could be readily furnished.

Mr. Henri Weiss showed models of two cases of hypertrophy of the gums. The first was a model of the mouth of a man who had been exhibited in Paris and elsewhere as "the calf-faced man," owing to his very remarkable appearance; it was a case of congenital hypertrophy of the gum. The other patient was a woman who for five or six years past had been troubled with slowly increasing bony hypertrophy.

Mr. Hepburn read notes of a case of dentigerous cyst of the lower jaw sent by Mr. Charles Sims, of Birmingham, and showed a model of the tumour and the denticles removed from it.

The patient was a healthy-looking boy, aged ten, son of a chemist and dentist, one of a family of six, all of whom were healthy, and presented nothing unusual as regards their dentition. The lateral and canine teeth on the right side of the lower jaw were absent, and the father said there had never been any temporary teeth in this situation, but that for some time past a swelling had been noticed which had gradually increased in size, and which had never occasioned any pain. Models were taken, and the patient was told to come again in a fortnight. At the next visit chloroform was administered, and Mr. Sims laid open the cyst. It contained no fluid, but the forty-four small denticles now shown were removed from it.

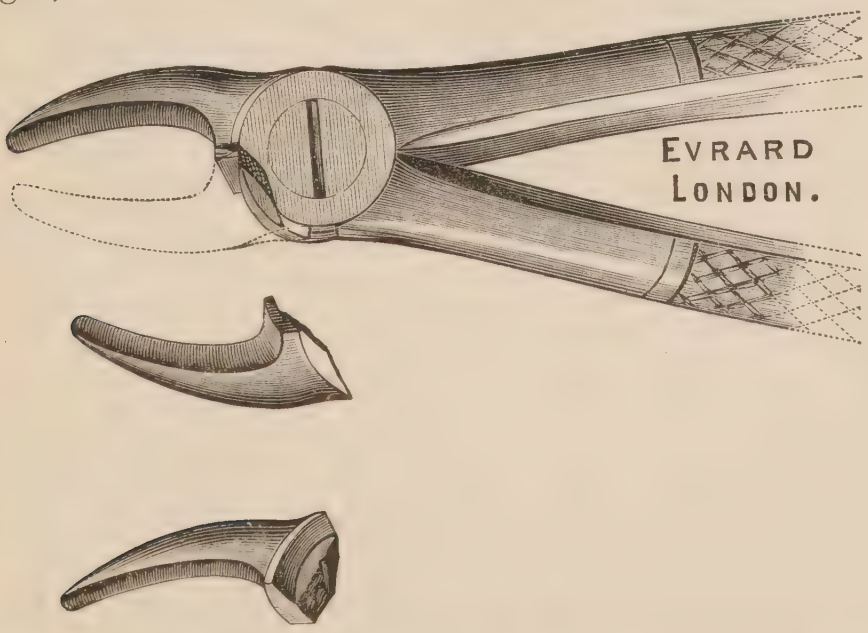
Sir William MacCormac then read notes of the following remarkable case in which one blade of a pair of bicuspid

forceps was impacted in the right bronchus for seven weeks and then removed by tracheotomy. The patient was a young woman, aged twenty-four, a domestic servant, who applied to Mr. J. H. Sanders, of Barnstaple, for the purpose of being fitted with a denture. On examining her mouth, Mr. Sanders found a number of unhealthy stumps in the upper jaw, and advised their removal. To this the patient consented, but begged to be allowed to take chloroform. The anæsthetic was accordingly administered by Mr. Jackson, a surgeon of Barnstaple, and Mr. Sanders extracted several molar roots on the right side. He then took up a pair of bicuspid forceps and tried to extract the right upper second bicuspid, but met with an unusual amount of resistance and the forceps slipped. He reapplied them and was about to make another attempt, using a little more force, when the palatine blade of the forceps suddenly broke off close to the joint and disappeared. The patient at once showed signs of impending suffocation, with extreme dyspnœa and lividity, and appeared for a time as if moribund. Artificial respiration was at once resorted to, the patient was inverted, and every effort made to relieve her of the fragment which had evidently passed into the air passages; but though the dyspnœa passed off after a time, all efforts to obtain the expulsion of the foreign body proved fruitless.

During the next five or six weeks the patient remained without any very urgent symptoms, though she suffered from pain to the right of the sternum, opposite the second and third intercostal spaces, together with constant spasmodic cough and bloody sputa, and she began to lose strength. At last, seven weeks after the accident, she was sent up to London and admitted into St. Thomas' Hospital. On stethoscopic examination rales were to be heard all over the right lung and a peculiar rasping sound at a point to the right of the sternum where the patient complained of pain. She had constant cough and dyspnœa, was unable to sleep at night, and was evidently getting rapidly worse. There could be no doubt that the foreign body was impacted in the right bronchus, and that there was little or no chance of its

being expelled by coughing. It was therefore determined to attempt its removal by tracheotomy.

Accordingly, on November 26th, being the third day after her admission, chloroform having been administered by Mr. Tyrrell, Sir William made an incision down the middle line of the neck from just below the cricoid cartilage to the sternal notich. Ligatures were placed round the isthmus of the thyroid body, which was divided between them, and an opening nearly 2 inches long made in the trachea. This was kept patent by means of silk threads, and forceps passed down. The left bronchus was found to be clear, but in the right a hard obstruction was met with at a distance of about 5 inches from the opening, and rather more than an inch beyond the bifurcation of the trachea. On passing down a bullet probe the characteristic ring of steel could be distinctly felt. Attempts were now made to remove the foreign body with the forceps, but for some time without success, owing to its smooth surface and wedge-like shape, as well as its firm impaction. Other forceps were tried and then a wire loop, but still unsuccessfully. At last, some silk having been wound round the blades of the forceps, a better grasp was obtained, and the fragment, which was fully an inch in length, was seized and withdrawn.



Slight hæmorrhage followed, but Sir William decided to close

the opening. The patient was at once relieved, and although some slight local broncho-pneumonia followed, it soon passed off, and ten days after the operation the temperature was normal and the patient made an excellent recovery.

Sir William added that most certainly no blame could be imputed to Mr. Sanders; the forceps bore the well-known name of "Evrard," and there were no external indications of any flaw.

Mr. Storer Bennett suggested that perhaps a magnet might have proved serviceable under the circumstances.

Sir William MacCormac replied that when he found the forceps would not grasp the fragment he sent to borrow a magnet, but could not obtain one at the moment.

The President congratulated Sir William MacCormac on his success. The case was one of great interest and importance to all members of the profession, since any one of them might meet with a similar accident. As regards this liability dental practitioners were entirely in the hands of the instrument makers, and could do no more than provide themselves with instruments made by some maker of repute. He was sure they would all sympathise with Mr. Sanders under the very distressing circumstances in which he had been placed.

He then called upon Mr. F. S. Eve, F.R.C.S., to read the paper of the evening on "Some Points in the Pathology of Cystic and Encysted Solid Tumours of the Jaws."

On Cystic and Encysted Solid Tumours of the Jaws, with observations on the Structure of the Enamel Organ.

By F. S. Eve, F.R.C.S.,

Pathological Curator of the Museum of the Royal College of Surgeons, Assistant Surgeon to the London Hospital.

Mr. President and Gentlemen,

It was with much pleasure that I acceded to the request of your Secretary that I should read a paper before this Society, knowing that I should have the honour of addressing gentlemen having an intimate knowledge of the subject I have chosen, although regarding it from a somewhat different standpoint to myself. Tumours, particularly cystic tumours, of the jaws have for some time attracted my attention, and they formed the subject of a lecture* which was published in the *British Medical Journal* in January, 1883. It is to some of the views therein brought forward that I desire, in part, to ask your indulgent attention, and I need hardly apologise, seeing the extent of contemporary medical literature, for passing to some extent over old ground, more

* An Erasmus Wilson lecture delivered at the Royal College of Surgeons, 1882.

especially as the conditions of the present meeting enable me to illustrate the subject by microscopic drawings and specimens.

It is my intention neither to speak of the single or simple cysts met with in the jaws—namely, the small inflammatory cysts attached to the roots of teeth, which Magitôt has designated as periosteal cysts,—nor of cysts directly connected with more or less perfectly developed tooth-follicles, which are included under the general names of dentigerous or follicular cysts. But, in the first place, I shall enter into the consideration of certain points in the pathology of the multilocular cystic epithelial tumour (formerly known as multilocular cystic disease, cystic or adeno-sarcoma) that appear to me to have a more immediate bearing on your speciality; it will, however, be necessary to prelude my observations by a brief description of the clinical character of these tumours.

This disease occurs at all periods of life from infancy to old age, but is commonest in early adult or middle age; of twenty-six cases which I collected, twenty patients had reached the age of twenty years when they came under observation. It more commonly affects the lower than the upper jaw, and the molar region, as in the odontomata, is usually, but not exclusively, involved. Its onset is insidious and its progress slow, extending in some cases over a period of twenty

years. The patient notices a swelling near the alveolus of a carious or inflamed tooth, or a blow has been received on the part, but in many cases no such exciting cause has existed. The swelling gradually increases, and the teeth overlying it become loosened and may fall out. Not infrequently a glairy fluid is discharged from a vacant alveolus, of which the orifice may become ulcerated.

In the lower jaw the morbid growth invades the cancellous tissue and expands the compact walls of the bone, chiefly the outer, giving rise to a prominence, which is at first rounded, but later, from the formation of numerous cysts, assumes a largely nodulated form. As its growth progresses the osseous walls become thinned, and in some parts yield to pressure with a parchment-like crackle, while in others they become absorbed and fluctuation may be obtained. In the upper jaw the growth projects into and distends the antrum, with at first little expansion of the outer surface; and the cyst formation is usually less marked.

A section of a typical specimen of the disease in the lower jaw displays an agglomeration of cysts, of sizes extending to an inch or more in diameter, and divided by thin septa of fibrous or, in some instances, of osseous tissue.

Most of the cysts are filled with a thick

glutinous fluid, and the larger often with a brown serous fluid. The advancing or younger portions of the tumour consist of a reddish-brown friable substance, not unlike, and which doubtless has often been mistaken for, a myeloid sarcoma. In some tumours the cysts are uniformly of small size.

I have shown that in minute structure these tumours are composed of branching and anastomosing rods or columns of epithelium, portions of which are cut off and form alveoli. The original germinal epithelium is modified in various degrees in different tumours, and in different parts of the same. The outer layer of cells, forming the columns and alveoli, become elongated or columnar; the central cells undergo colloid degeneration, and give rise more or less perfectly to the appearance of a reticulum of stellate cells, thus reproducing the structure of the rudimentary enamel organ.

The scanty stroma is composed of fibrous tissues, but when abundant consists of embryonic tissue in various stages of development towards the formation of fibrous tissue.

The colloid degeneration of the cells, and the accumulation of fluid in the alveoli, gives rise to the formation of cysts.

It is to the mode of degeneration of these cystic tumours that I wish to call your notice, not only on account of its pathological interest, but chiefly

because it appears to me materially to assist us in arriving at a conclusion in regard to a point in the histology of the development of the teeth which is not finally settled, namely, the mode of degeneration and removal of the central cells of the enamel organ.

Before discussing this question, let me in a few words recall to your minds the salient facts of the development of the teeth.

About the seventh week of embryonic life a downward projection or ingrowth of the epithelium lining the dental groove takes place along the whole length of the jaws. At certain points corresponding to the future teeth, papilla-like projections extend downwards from this ingrowth to form the rudimentary enamel organ. Coincident changes take place in the subjacent embryonic tissue resulting in the formation of a mass of gelatinous connective tissue, the tooth papilla, of which the round upper surface projects into and invaginates the rudimentary enamel organ, converting it into the enamel cap. The enamel organ is at first composed of round rudimentary epithelium, lined by a layer of elongated or sub-columnar cells, like to and continuous with those composing the deep layer of the epithelium of the mouth. In the progress of its development, the cells composing the enamel cap are differentiated. The inferior or inner layer—that nearest the tooth papilla—forms very

regular columnar cells, from which the enamel is subsequently developed; the outer layer remains for a time polyhedral; while the intermediate cells, or those composing the middle layer, undergo a peculiar transformation, resulting in the formation of a tissue composed, apparently, of stellate anastomosing cells, and formerly thought to be mucous connective tissue; this layer subsequently disappears. Two views may be entertained regarding the manner in which this peculiar change in the middle layer of cells is brought about: the one, which I must own is very generally accepted, and receives the support of the high authority of Dr. Klein,* is that the cells are compressed and flattened by an accumulation of fluid between them, that is, in the intercellular substance; the other, that the cell substance itself is degenerated, and this view is apparently held by Waldeyer, who says that he is unacquainted with a similar metamorphosis in any part of the body except in the epithelium of the Graafian follicles, "but never occurring [there] in as regular a manner."† He, however, does not enter into an explanation of the nature of the process.

Now I shall endeavour to show that the latter is the correct view, and that the metamorphosis in question is the result of a form of liquefaction

* Atlas of Histology.

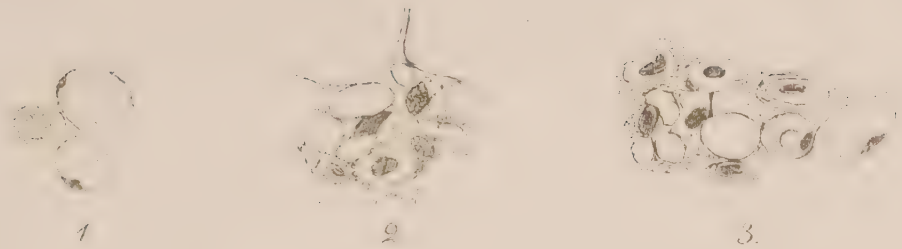
† Sticker's "Handbook of Histology," vol. i, p. 280.

or colloid degeneration of the protoplasm. But, before arguing from pathological appearances in order to elucidate histological changes, it is necessary to substantiate more completely the fact that these tumour formations are structurally analogous to the rudimentary enamel organ. The resemblance was not only observed by myself in greater or less perfection in twelve specimens which I examined, but two cases have been also described in Germany by Falkson and Bryck respectively, and these so closely resembled the enamel organ, that, from this circumstance mainly, they argued that the growths proceeded from the rudiments of a tooth arrested in its development. Quite recently Bernays, an American surgeon, in describing a similar case, has adopted the same view.

It is true that the tumour formations present considerable differences among themselves, but the forms are all transitional, and grades from the most elemental to the most distinctly marked type of the rudimentary enamel organ, are even observable in the same tumour.

The mode of degeneration of the epithelium is more clearly evident in those tumours in which the cyst formation is well marked. The central cells of the columns and alveoli become much enlarged, finely granular, and the nucleus is pressed against the cell wall. Then the protoplasm of the

individual cells becomes merged into a general mass, while the nucleus and the portions of cell wall attached to it remain visible, and have somewhat the appearance of flattened cells with processes lying in the interstices of the degenerated cells. In other instances a drop of colloid substance forms within the cell, by which the protoplasm is expanded into a narrow band, and the nucleus being pressed to one side, the characteristic "signet-ring" form is produced. (See Fig. I.) The approximation of such cells with their nuclei at the points of contact will, as you may readily conceive, give rise to a wide mesh-work. In the layer intermediate between the central and peripheral portions of the columns, the degenerative change is less extensive and the resemblance to the central network of the enamel organ is exact (Figs. II, III, IV). Vacuoles form at one or more points in the slightly enlarged cells, sometimes separating the nucleus, which for the most part retains its rounded form, from the cell wall. A kind of solution of the protoplasm takes place, the vacuoles in adjoining cells run together, and finally the nuclei remain connected only by filaments of undissolved protoplasm and the vestiges of the cell walls. Further, in studying with high power immersion lenses some beautiful sections of the rudimentary enamel organ kindly lent me by Mr. Charles Stewart, I observed quite unmistakable "signet-



1 2 3.

4 5.

a

b

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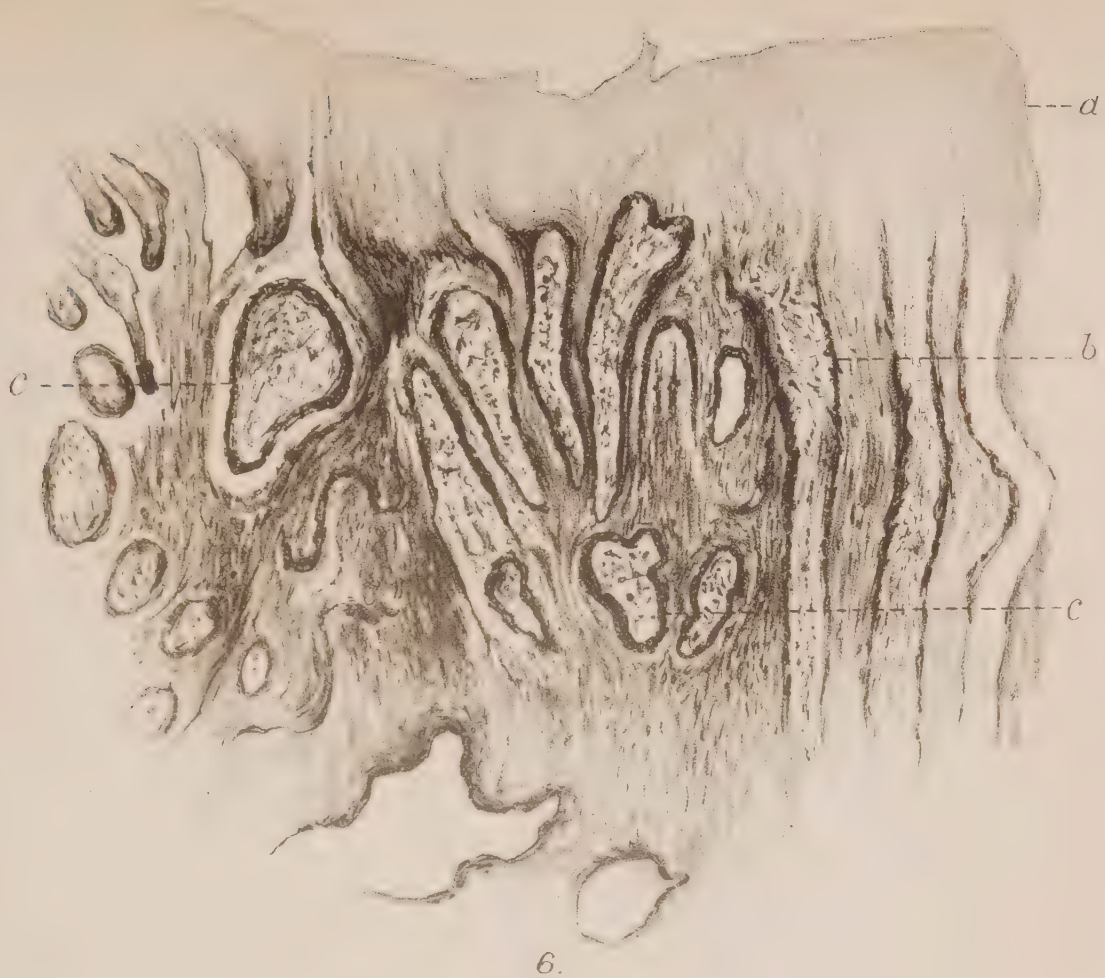
F.S.E. dlt. Harrison & Sons lith.



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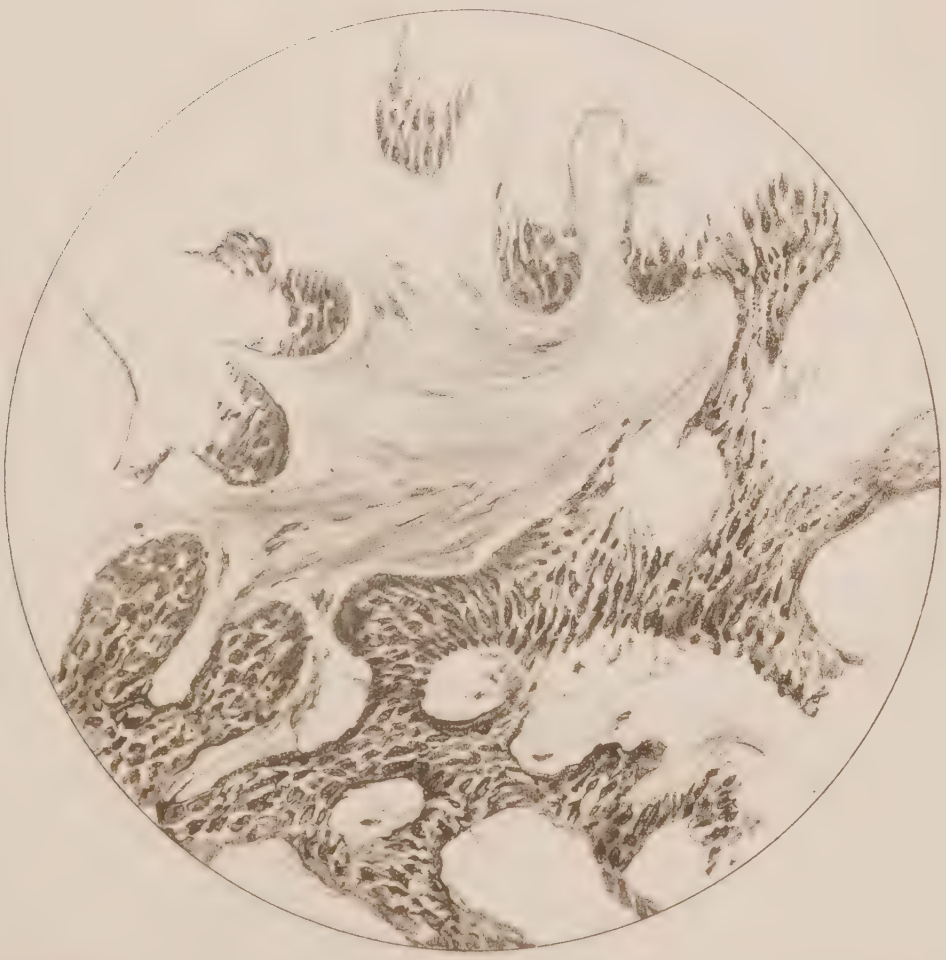


ring" cells (see Fig. V), and could in places make out a swelling with hyaline degeneration and vacuolation of the protoplasm prior to the formation of a network. If the epithelial cells were merely compressed by fluid accumulating between them, there would be no swelling of their substance, and in place of the indistinct fragment of the undissolved protoplasm around the nucleus, there would be a well-defined contour produced by the wall of the compressed cell.

Again, having already shown that the pathological products are structurally identical with the developing enamel organ, I contend that since the network in the former is clearly due to colloid degeneration of the cell substance, the same explanation also holds good for the latter; for unity of type is as clearly evident as regards mode of development and structure between pathological formations and normal tissues as between the lower and higher organisms of the animal kingdom, and unity of structure and form is the resultant of similar innate tendencies in the ultimate elements of the tissues, namely, in the cells themselves.

Before closing this portion of our subject, permit me to say a few words on the mode of origin of the multilocular cystic tumours. The inference naturally drawn from their structure would be, that they originated directly from the enamel

rudiment of an aborted or supernumerary tooth—in fact, that they are a form of embryo-plastic odontome. But of this there is no evidence, and the age at which they commonly occur is distinctly against such an assumption. Bryck is of opinion, but as I think on insufficient grounds, that the history in his case supported this conclusion.

In some two or three of the twelve specimens which I examined there was distinct evidence that the tumours proceeded from an ingrowth of epithelium continuous with that of the surface of the gum, and in two instances they occupied the margin of ulcerated alveoli from which teeth had fallen out. (See Fig. VI.) In another example there were flask-shaped masses of degenerating epithelium extending downwards from the gum between the teeth.

Since these observations were published M. Malassez communicated to the Société de Biologie of Paris* the result of the examination of a normal maxilla, carried out with the view of ascertaining if epithelial structures persisted in the neighbourhood of the alveoli, from which the cystic tumours of the jaws might originate. His search was rewarded by finding spherical, oval, and cylindrical masses of epithelium within the peri-odontal membrane (alveolo-dental ligament), and extending from the gum to the apex of the fang, but chiefly distributed

* "Journ. Soc. de la Biologie," 1884, p. 242.

below the neck and at the upper part of the root. These masses, he thinks, proceed from some of the epithelial formations accompanying dentition, probably from the external layer of the enamel organ. In this fact we have very strong confirmation of my observation above alluded to, and an explanation of the circumstances that these tumours usually begin near alveoli, soon lead to the extrusion of teeth, and that their interior often communicates with the mouth by an open alveolus.

In conclusion of this portion of our subject I beg to submit that the multilocular cystic tumours represent a distinct variety originating from epithelial ingrowths around the dental alveoli, possibly (if I may be allowed to indulge in a harmless speculation) in ingrowths the sole representatives of teeth long since suppressed in the process of evolution of our species, or from an overgrowth of the normal epithelium of the gum; a variety of tumour owing its peculiarities in structure and secondary metamorphosis to the inherent developmental peculiarities or tooth-forming properties of the epithelium from which it springs. It belongs to the group of epitheliomata, and possesses a decided, although not a high, degree of malignancy—facts which I endeavoured to prove in the lecture before alluded to. General dissemination of the tumour throughout the system may even take place, and the frequency of recurrence

is now placed beyond doubt by cases cited by Mr. Heath in the recent edition of his "Injuries and Diseases of the Jaws," a work which may almost be considered as the foundation of our knowledge of tumours of the jaws. In one of these cases the disease appeared on the cheek as "a typical epithelial ulcer."

Clinically resembling but differing pathogenetically from the multilocular cysts, is this, I believe, unique specimen of single cyst occupying the whole of the right side of a jaw.* It contains no trace of a tooth, and the structure of its wall shows that it is not dentigerous or follicular in the strict sense of the term, for I found that it was lined by a thick layer of small round epithelium. I have hazarded the conjecture that it may have originated from the expansion of a rudimentary enamel organ owing to the collection of fluid in its interior.

I will now with your permission pass on to the second part of my subject, and will bring to your notice one or two remarkable examples of encysted tumours of the jaw, that is, of solid tumours which, having expanded the walls of the jaw, are enclosed by a bony capsule. I need scarcely remind you that clinically there is at times considerable difficulty in distinguishing such tumours from cysts or cystic tumours. Their external

* Royal College of Surgeons' Museum, No. 2194.

appearances are often similar, in both the parchment-like crackling may be obtained, and, in many cases, a diagnosis is impossible without the aid of a puncture.

For these reasons, and from the fact that they may both be connected with anomalies in the development of the teeth, it may not be disadvantageous to place them in juxtaposition.

All the varieties of tumours of the jaws, with the exception of the osseous and cartilaginous, may be more or less definitely encapsuled or encysted. The fibrous and fibro-sarcomatous, sarcomatous, central myeloid tumours, odontomata, and lastly, solid epithelial tumours having no relation as regards their origin with the tubular carcinomata of the superior maxilla which spring from the epithelium and glands of the palate and antrum.

The specimens I am about to describe are at least closely related to, and should, I think, be classed among the odontomata. The odontomata, as you are well aware, were divided by Broca in his classical essay into odontomes embryo-plastique, odonto-plastique, coronaire, and radiculaire.

In the class of embryo-plastic odontomata, Broca includes all encysted sarcomatous and fibrous tumours of the jaws, which he regards as the product of a tooth-rudiment in its earliest stage of development.

The odonto-plastic odontomata are tumours of which the tissues have reached a higher stage of evolution. They are either surrounded by a layer of odontoblasts, or have become more or less completely dentified. The distinguishing characters of the coronary and radicular odontomes do not concern our present subject.

Case 1.—A very curious and, I believe, unique tumour came under my notice while I was Surgical Registrar in St. Bartholomew's Hospital. James B., aged twenty-four, was admitted to Henry Ward, under the care of Mr. Thos. Smith, with a swelling on the outer surface of the left side of the lower jaw. He first observed a prominence four years and four months previously, and for a year and a half before that had suffered pain in the part. For the first six months there was a discharge from the gum over the swelling. Eighteen months after the first appearance of the tumour two healthy teeth, situated in the affected part of the jaw, were extracted, and another at a later period.

The swelling had not increased during the last three years, and was not painful.

Condition on Admission:—A hard, rounded swelling, about three-quarters of an inch in diameter, projected from the outer surface of the lower jaw at the level of the molar teeth; the corresponding portion of the inner surface of the

jaw was slightly thickened. No crackling but slight and hardly perceptible yielding could be obtained by firm pressure over the tumour. A slit-like ulcerated aperture opened on the alveolar surface of the tumour, into which a probe could be passed for some distance. His dentition was very irregular, the full complement of teeth having only existed in the left superior and inferior maxillæ. In the right superior maxilla the canine and second molar, and in the right inferior maxilla the canine and first bicuspid, were absent.

The operation was delayed for a time on account of an attack of inflammation of the jaw, with much swelling of the cheek, which came on immediately after his admission.

Operation :—An incision having been made along the lower margin of the ramus, the tumour was exposed by reflecting the cheek.

Its outer wall was removed with bone forceps, and a cavity, about an inch and a quarter in diameter, and filled with a pale pinkish fleshy growth, was exposed. The growth was scooped out and was not adherent to the walls, which were smooth and glistening.

The cavity was plugged.

The subsequent progress of the case was perfectly satisfactory.

Mr. Mudge, of Hayle, Cornwall, the patient's medical attendant, has kindly informed me that

when last heard of, more than two years after the operation, the man was in excellent health, and there was no return of the tumour.

The minute structure of this tumour presents many interesting features. It was composed almost entirely of small compressed or angular epithelium, in parts (as shown in the accompanying rough sketch) arranged in anastomosing bands which often enclosed rounded spaces, or terminated in club-shaped ends (Fig. VII). Occupying these spaces, and sparsely distributed through the tumour, was a gelatinous fibrillar connective tissue containing branched and round cells. In one section I observed two parallel bands of very large elongated columnar epithelial cells, separated by a narrow band of epithelium having the peculiar characters of those forming the central layer of the enamel organ. (See Fig. VIII*a*.) Scattered at wide intervals were bands of curiously modified connective tissue composed of long clearly defined slender fibrils, and lines formed by the juxtaposition end to end of excessively slender and much elongated fusiform cells. The fibrils and lines were parallel and separated by a clear ground substance. (See Fig. VIII*b*.) There was no evidence of cyst formation in the tumour, and but slight traces of degeneration of epithelium. The relation of the various tissues composing the tumour to those of a rudimentary tooth will be, I think, at once apparent

from the accompanying sketches. Both the form and mode of growth of the epithelium is suggestive of the enamel rudiment, and the solitary band of columnar cells with the intervening network can scarcely be regarded otherwise than as an evolution of the epithelium in the direction of enamel formation. The gelatinous connective tissue likewise suggests the structure of the tooth papilla; while the bands of fibrils may be considered as a modification of connective tissue in the direction of the formation of dentine. If I am correct in believing this to be the case, the specimen throws some light on the mode of formation of dentine, for the fibrils are clearly the product of elongated fusiform connective tissue cells, the intervening substance being of the nature of an intercellular matrix. This seems the more probable as it places the formation of dentine on the same lines as that of bone; the bone lacunæ, and the dentine fibrils are both modifications of connective-tissue cells, and the ground substance is produced by calcification or dentification of the intercellular substance.

Case 2.—I may here briefly allude to a tumour which was not encapsuled, but which had, in its minute structure, some relation to the preceding. It consisted of round and spindle-shaped nuclei in a homogeneous or finely fibrillar connective tissue, and scattered throughout it were irregular masses and rods of round epithelium, surrounded

by a layer of elongated or columnar cells. The specimen was a very large tumour, involving two-thirds of the lower jaw, and was originally described as a sarcoma. (See Royal College of Surgeons' Museum, No. 2234). It was removed by Mr. Heath from a man aged thirty-two, who eleven years before presenting himself for treatment, noticed a small hard swelling just below the right canine tooth. It remained stationary for five or six years, and began to grow rapidly after a violent blow on the face.*

Case 3.—This specimen† was sent to me by Mr. T. Smith, by whom it was removed. It comprises a portion of the right side of a lower jaw in the region of the bicuspid teeth. The walls of the bone are expanded by a firm rounded tumour an inch in diameter, having a smooth homogeneous section. The smooth internal surface of the tumour was separated from its bony capsule except above, where it was firmly attached to an irregular mass of osseous substance, which projected downwards from the alveolar surface of the cyst. On closer examination, a small rounded nodule of enamel was found attached to this mass, and may be considered the aborted crown of the rudimentary papilla from which the tumour sprang. The substance of the tumour protruded through an open

* This case is noticed in my lecture above referred to. See Fig. III.

† Preserved in Royal College of Surgeons' Museum, No. 2233.

alveolus, from which the first bicuspid had been removed, after becoming loose. A tooth, probably the displaced first molar, was divided in the operation near the lower part of the cyst, in the wall of which it was firmly embedded. The canine, although inclined backwards, occupied its normal position.

Microscopically the tumour was composed of round and elongated cells, in places undergoing development into fibrous tissue. A layer of elongated cells, resembling odontoblasts, and arranged vertically along the surface, were observed at one part of the tumour.

Mr. Smith has kindly informed me that the patient was a boy, aged fifteen. The tumour was enlarging, but there was no pain; and no history of injury was obtainable.

Perfectly encysted fibro-sarcomatous and fibrous tumours of the jaws do not appear to be of common occurrence. There are two or three typical specimens in the Museum of the Royal College of Surgeons. Mr. Heath* has only observed one case, and he doubts the existence of the embryoplastic odontomata as a distinct class. Broca met with an example in which partial dentification had taken place on the surface of an encysted fibroma. Duplay† has recorded a case in a girl aged twelve,

* *Op. cit.*, p. 267.

† *Op. cit.*, p. 313.

in many respects closely resembling Case 3. A tumour of two years' duration, and occupying the situation of the right incisor and canine teeth of the upper jaw, was destroyed with the thermo-cautery. It returned in three months, and on removal was found to be an encapsuled fibroma of the size of a hazel nut. The incompletely formed crown of a tooth, presenting a resemblance to the canine, projected from the lower and outer surface of the tumour opposite its point of attachment to the cyst wall.

It remains now to consider the relation which the tumours in the cases related bear to other tumours of the jaws and to each other. The relations of the first case of epithelial tumour to the multilocular cystic epithelial tumours of the jaws is undoubtedly close, but there are some important structural and clinical differences. The solid tumour was distinctly circumscribed and non-infiltrating; its structure was more complex, apparently including all the tissues of a rudimentary tooth, and showing no trace of cyst-formation. Clinically there was the significant fact that it ceased to enlarge after the age of twenty-one, a peculiarity shared by other highly organised tumours, as exostoses and digital enchondromata.

Case 3 and Duplay's case present but slight clinical differences from a very large class of more or less completely encapsuled sarcomata of the

jaw in which the distinguished feature of these tumours, namely, the presence of definite dental structures, is wanting; and in Case 2, which differs structurally from many odonto-plastic odontomes merely in the circumstance that its tissues are uncalcified, we have all the characters of an infiltrating malignant tumour.

It is therefore evident that the tumours of which these four cases are examples shade off almost imperceptibly into the general class of tumours affecting the jaws on the one hand, and on the other their affinities with the highly organised odontomata are so close that it seems convenient to retain for them the names of embryo- and odonto-plastic odontomata. In Case 1 no teeth were absent; in Case 3 no sufficiently definite information existed, but it was stated that no teeth were missing; and in Duplay's case the fact that the tumour occupied a position anterior to the molar region renders it probable that the pointed form of a supernumerary cusp was mistaken for that of the canine, therefore the evidence that these tumours originated from the rudiments of milk or permanent teeth is wanting, or inconclusive. And it may be questioned if in some other recorded cases of odonto-plastic odontoma the evidence that the tumour proceeded from the rudiment of some one tooth has not often been forced. Further, it appears unnecessary to

assume that these tumours necessarily spring from the rudiments of aborted teeth, for, as in the case of the multilocular cystic tumours, they may owe their peculiarities in structure to the tooth-forming properties of the tissue in which they arise, whether they spring from the remains of latent embryonic tissue and rudiments of suppressed teeth, or from mature tissues stimulated to active growth by chronic hyperæmia the result of irritation or injury.

If I may be permitted to offer an opinion on a subject with which you must necessarily be better acquainted than myself, I would suggest that from the point of view of general pathology, Broca's class of odontomata do not form a homogeneous group, but includes types of all pathological formations, from the most rudimentary sarcoma up to the true hypertrophy; that the odontomes coronaire and radiculaire may rather be regarded as forms of hypertrophy, or giant growths of teeth, than as true tumours, to which class, as a modified variety, the odontomes embryo-plastique and odonto-plastique undoubtedly belong.

In conclusion, I beg to thank you for your kind attention to these, I fear, dry details, and shall consider any trouble I may have taken in the preparation of this paper amply repaid if further facts can be gathered in regard to these peculiar tumours, which lie on the border-land

between tumours generally and odontomata, and, especially, facts relative to their connection or otherwise with the rudiments of normal teeth.

DESCRIPTION OF PLATES.

Fig. I.—Colloid degeneration with the formation of "signet-ring" cells, from the central cells of the columns and alveoli composing the multilocular cystic epithelial tumours. Magnified 650 diameters.

Figs. II, III, IV.—Process of vacuolation and degeneration of epithelium in the above-mentioned tumours, giving rise to a pseudo-reticular tissue. Magnified 650 diameters.

Fig. V.—A portion of the middle layer of a normal enamel-organ showing signet-ring cells and vacuolation of the protoplasm. Magnified 650 diameters.

Fig. VI.—Semi-diagramatic sketch of a vertical section of the gum at the margin of an open alveolus overlying a multilocular cystic tumour,—to show an ingrowth from the epithelium by which the tumour apparently originated.

a. Margin of alveolus.

b. Ingrowths of epithelium.

c. Alveoli containing pseudo-reticulum and lined with epithelium. Low power.

Fig. VII.—Sketch of solid encysted epithelial tumour (Case I), showing anastomosing bands of epithelium enclosing rounded spaces, with loose fibrillar connective tissue in the interstices of the epithelial structures. Drawn with Obj:D. Zeiss.

Fig. VIII.—From the same specimen as Fig. VII.

a. Portion of parallel rows of enamel-like cells.

b. Dentine-like matrix showing delicate fibrils formed by the apposition end to end, and the elongation of spindle-cells. Magnified 650 diameters.

Discussion.

Mr. Charles Tomes said he had observed in at least one specimen of calcified odontome a structure which was just such as would be produced by calcification in a tumour like that depicted in one of Mr. Eve's diagrams, *i.e.*, it was mostly made up of the products of calcification of an infinitely branched enamel organ, there being but little trace of dentine or of anything which appeared to have been derived from the calcification of a dentine pulp.

But he was more particularly interested by Mr. Eve's demonstration, that in the epithelial masses the axial portions became transformed into a stellate tissue by a process of colloid degeneration. He had long been accustomed to teach that the stellate reticulum of the enamel organ had little functional significance, and that it was in fact a retrograde product. This view he had illustrated by reference to a fact in comparative anatomy which appeared to him almost to prove the point. The canal of the poison fang of a snake was, as was well known, formed by the deepening of a groove on the face of the tooth, the lips of the groove coming together and so forming a complete tube. The canal was therefore part of the outside of the tooth, and as the groove closed, the portion of the enamel organ covering this surface became enclosed in the canal, and on examination soon after this change had taken place it was found that whilst the enamel organ on the rest of the tooth showed the usual prismatic cells and formed thin enamel, in the groove and in the canal these columnar cells passed by easy transitions into a reticulum of stellate cells, with which at a certain stage of development the whole poison canal was filled; later this withered away and left the tube empty. In this instance, therefore, the characteristic cells of the enamel epithelium, when their function was gone, were seen

to undergo a degeneration precisely like that which Mr. Eve had so clearly described as a colloid degeneration occurring in the enamel-organ-like epithelium of certain tumours.

The PRESIDENT said he regretted that time would not permit of the further discussion of Mr. Eve's interesting paper. It contained several valuable suggestions, and would, he hoped, lead to further investigations. He thanked Mr. Eve in the name of the Society, and also Sir William MacCormac, Dr. Elliott, Dr. Cunningham, and others for their communications.

The next meeting, which would be the Annual Meeting for the election of officers, &c., would be held on January 11th.

The Society then adjourned.

Odontological Society of Great Britain.

ANNUAL GENERAL MEETING.

January 11*th*, 1886.

C. SPENCE BATE, F.R.S., PRESIDENT, IN THE CHAIR.

THE Minutes of the previous meeting having been read and confirmed,

The PRESIDENT declared the ballot open for the election of office-bearers for the current year, and Messrs. E. Bartlett and W. Hern were chosen in the manner prescribed by the bye-laws to act as Scrutineers of the Ballot.

The PRESIDENT announced that the following gentlemen had been duly nominated as candidates for election, and would be balloted for at a subsequent meeting, viz.:—

MESSRS. W. J. ENGLAND, L.D.S.Eng., 40, Wimpole Street, Cavendish Square, London; and

THOMAS FRED. BARTON PALMER, M.R.C.S. & L.D.S.Eng., Priestgate, Peterborough.

The following candidate was balloted for and elected a non-resident member of the Society:—

R. L. MARKHAM, L.D.S.I., 19, Eldon Square, Newcastle-on-Tyne.

MR. S. J. HUTCHINSON related the following case, which, he said, although not a very uncommon one, still presented

some points of interest, and might therefore be worthy of the attention of the Society.

In October last a gentleman came to him suffering from almost complete closure of the jaws; he could only separate them about a quarter of an inch, and was, of course, unable to eat. He had been in this condition about a month. Mr. Hutchinson found that the inability to move the jaws was due to muscular contraction, with infiltration and induration of the surrounding tissues, and diagnosed an impacted wisdom tooth, but was unable to make a satisfactory examination of the mouth.

At the patient's next visit gas was administered and the jaws separated to some extent by a screw gag. It was then found that the left lower wisdom tooth was completely buried under the ascending ramus of the jaw; it was also decayed and had an abscess at the root. In order to get at it Mr. Hutchinson felt obliged to extract the adjacent second molar, and this was at once done. After an interval of a few days gas was again administered and an attempt made to dislodge the wisdom tooth, but the patient recovered himself before this could be effected.

Perceiving that the operation would be a difficult one, Mr. Hutchinson arranged with the patient that he should have chloroform at his own house, and this time the tooth was successfully extracted, though not without a good deal of trouble, for the tooth was lying horizontally and buried under the ramus of the jaw.

Mr. Hutchinson thought that the plan of administering chloroform at the patient's own house, instead of at that of the practitioner, reduced the risks and inconveniences of this agent to a minimum. The patient could be operated on undressed and in a recumbent position; he was not fatigued, as he might be when he had to come some distance in a fasting condition, and he was less flurried. Finally, he could lie quietly after the operation and recover himself at his leisure.

Another point of interest in the case was the length of

time the contraction persisted after extraction of the tooth. Three weeks after the operation the patient could only open his mouth three-quarters of an inch, and he had, in fact, only just regained the free use of his jaw, though the operation took place in October.

Mr. Charters White said that about two years ago he had been called upon to treat a precisely similar case. Thinking from the amount of indurated swelling, &c., that there must be some disease of the jaw, he sent the patient to Mr. Christopher Heath, but that gentleman sent him back again, saying he considered it a case for a dentist, and on examining the patient more carefully Mr. White discovered that the cause of the mischief was an impacted wisdom tooth, embedded in the ascending ramus of the lower jaw. The patient could not separate his teeth more than a quarter of an inch, so that it was difficult to introduce forceps, and still more so to manipulate them in the mouth, but Mr. White managed to reach the tooth with some long narrow curved forceps, and to raise it out of its socket, and at the patient's next visit, the swelling having somewhat diminished, he succeeded with the same forceps in removing it altogether.

Mr. Henri Weiss said that in five or six cases of prolonged operations in the mouth, he had used the well-known A.C.E. mixture, composed of alcohol one part, chloroform two parts, and ether three parts, by measure, and had found it act very satisfactorily. The patients recovered quickly, and there were no bad after-effects.

Mr. R. H. Woodhouse said he knew that the extraction of lower wisdom teeth was sometimes attended with a good deal of difficulty, and he believed that this arose from overlooking the fact that these teeth, when misplaced, were almost invariably inclined to the inner side of the ramus. He found that by inserting an elevator on the outer side, and making a continuous movement inwards, he could dislodge them without any trouble. He believed the difficulty arose from making an outward movement; it should be entirely inwards.

Mr. A. S. Underwood said he feared the communication he was about to make would be considered "dry" by many of those present, since it would only be interesting to those who were fond of microscopical investigations.

In the years 1878 and 1879, Dr. Bodecker, of New York, published in the "Dental Cosmos" some papers on the microscopical anatomy of the teeth, in which, amongst other things, he asserted that the presence of protoplasm between the fibres of the enamel could be demonstrated by staining sections with chloride of gold. He described his process as follows:—He first decalcified the teeth by means of chromic acid, then cut sections, and stained these by placing them in a solution of chloride of gold, and exposing them to sunlight for twenty-four hours or more. Now up to that time it had always been stated that chloride of gold would only stain tissues which were absolutely fresh. The text-books said it was useless to attempt to stain tissues which had been deprived of life for more than an hour, and a distinguished microscopist to whom Mr. Underwood applied for information on the subject, replied that it was hopeless to attempt staining with the chloride unless the tissues were fresh, and even in that case four out of five of his sections would turn out failures.

Wishing to verify Dr. Bodecker's observations, if possible, Mr. Underwood undertook a series of experiments in order to ascertain whether it was possible to stain decalcified sections with this reagent, and what was the best method of using it.

His results with the method described by Dr. Bodecker had been uniformly unsatisfactory; he could not get a single section which showed anything clearly. But he found, nevertheless, that any section could be stained, and that it really did not matter whether it was fresh or not. The method which he had found the best, and which he had finally adopted, was as follows:—

He immersed the section, whether cut from a decalcified tooth or ground down from a hard one, in a solution of

carbonate of soda for an hour. Then he placed it in a solution of chloride of gold, *which must be neutral*, and left it in the dark for another hour. It was then again placed in the carbonate of soda solution for a few minutes, and then transferred to a one per cent. solution of formic acid, and kept warm over a water bath for about an hour and a half. Finally the section was mounted in glycerine jelly, *not* in Canada balsam. Sections which had been decalcified by chromic acid took longer to stain than those which were fresh, but the whole process only occupied from three to four hours, instead of at least twenty-four as in the old method, and the result would be found far more satisfactory. The usual needles, or any steel instrument, must not be used for manipulating the sections; some non-metallic substance, such as a quill tooth-pick, should be used instead.

He found that the most satisfactory method of grinding down hard sections was to grind them tolerably thin against a fine corundum wheel and afterwards to finish with an Arkansas wheel. In this way the section could be ground down to any required thinness with little risk of injury.

Mr. Charters White said he gathered from Mr. Underwood's remarks, that though it was possible to stain a decalcified section, it was better to grind down a fresh section and stain at once?

The President remarked that grinding down a hard section between two Arkansas stones saved both the operator's time and his finger.

Mr. Underwood replied that fresh sections were not only easier to stain, but were in all respects much more satisfactory than those which had been decalcified, since the former presented the tissues in their natural condition, whilst in the latter they were more or less affected by time and by the reagents. Consequently, when decalcified specimens were used, there was always a doubt whether the appearances seen were really natural, or whether they were the effect of the reagents. He thought the use of the finger was the

safer way of finishing a thin section, and if necessary the finger could be protected by attaching the section to a piece of cork or rubber.

Dr. George Field presented to the Society some samples of Dennison's absorbent cotton, an American preparation. He had given it a thorough trial, and was convinced that there was nothing which surpassed it as an absorbent for dental purposes.

He wished to suggest a new use for Cocaine,—new, at least, to some of those present, viz., in the fixing of the rubber down by means of a ligature round the tooth, especially in the cases frequently met with where it was necessary to force both the rubber and ligature between the tooth, or teeth, and gum, on the approximal and buccal surfaces of the former. His method of using it was as follows:—He first thoroughly dried the cavities and the adjacent gum margins, then by means of a wedge-shaped piece of wood he applied the cocaine between the teeth and the gums, first adjusting a napkin as a protection from moisture. He preferred to use the crystals. Then he prepared the rubber, elastic bands, weights, ligatures, &c., and when everything was ready to hand he made another application of the cocaine. On now proceeding to adjust the dam, it would be found that the ligatures could be forced well under the gum with but little, if any, pain to the patient, provided that the application had been properly made. This operation, which, though absolutely essential for the success of fillings in the positions named, was usually exceedingly painful, was thus rendered almost painless; a good view of the margins of the cavity was thus obtained, with dryness, and it greatly facilitated the removal of all surplus material overhanging the margins of the cavity, an oversight which, in his experience, was the cause of more failures than any other defect in filling operations.

Lastly, if not taking up too much time, he would venture to offer a few remarks on the question of the extraction or

the retention of roots. When should roots be extracted, when retained? When was it advisable to pivot, and when not? His remarks on this subject must necessarily be very general.

Preparatory to the insertion of an artificial denture all roots which could not be put into a good healthy state, fit to receive a crown, should be extracted. In the case of patients who, it might reasonably be expected, would not take sufficient care to keep their teeth, roots, and gums in a cleanly condition, it was wiser to extract all roots; otherwise in from six to twelve months the result of the want of judgment would be seen in swollen face and gums, abscesses, &c., and a state of mouth generally which was a source of great discomfort to the patient himself, disgusting and offensive to his friends, and discreditable to the operator.

He expected to meet with the usual objection—the consequent absorption of the alveoli, &c. But this should have no weight in comparison with the inevitable bad results just named; in addition to which there could be little doubt that the quantity of suppurative matter constantly passing into the stomach must be prejudicial to the health of many patients. If the roots of any of the ten anterior teeth of the upper jaw were strong, pivoting in the best possible manner should be given the preference over a plate, as being less liable to injure other sound teeth and of greater practical service, provided the operation be performed with even a moderate degree of skill; giving special attention to the stopping of the foramen of the root, obtaining a good joint between the root and crown, having no shoulder either of root or crown, and lastly removing every particle of the cement used for fixing the crown which may have been pressed out at the joint.

Speaking from his own observation, he had never yet seen a case for the insertion of a full denture, the conditions or circumstances of which would warrant the retention of the roots; whereas he had met with cases in which the retention of numerous diseased roots covered by a plate had proved prejudicial to the general health of the patient.

He did not present these suggestions as being anything

new, but rather to call attention to the fact, which at times seemed to be lost sight of, that the mouth should be treated in the same way as any other part of the body, and that it was the duty of the dental practitioner to maintain it in a healthy condition by every means in his power, therapeutic as well as mechanical.

Mr. Storer Bennett showed a lower jaw, found at Bath some years ago amongst Roman remains, which had been presented to the Museum by Mr. Forsyth. On comparing it with a typical modern specimen several differences would be apparent, especially the distances between the condyles and the large size of the ascending rami. There was but slight mental development, and the teeth were not quite regular; they were much worn, but there were no signs of caries, and contrary to what might have been expected, the wisdom teeth were small.

Dr. Geo. Cunningham showed some specimens illustrating the difficulties and disappointments of Continuous Gum Work. He had used the same furnace (Fletcher's) throughout, the details of the process had been carried out in the same way and with the same amount of care, and yet after a period of success, when he thought he had conquered all difficulties, several cases in succession had turned out badly, the enamel being unequally fused and cracked on the outside of the plate. He could not himself explain the cause of his non-success, nor could he get any one else to explain it. The only difference between the good plates and the bad was in the enamel used, though both had been obtained from the same makers, the S.S. White Company, but that used for the successful cases had been on hand a long time, whilst new enamel had been used for the failures. He should be very glad if any one present could tell him whether their experience had been at all similar, or could enlighten him as to the probable cause of his failures.

He wished also to call the attention of the Society to Dr. Land's suction chamber; he handed round a denture made

according to his pattern. Dr. Land's suction chamber was large but shallow. He himself had for some time past altogether abandoned the use of these chambers and used the Fulsome ridge, but lately he had been induced to make some comparisons between the two, and had found Dr. Land's method of great use, and he could therefore recommend others to give it a trial.

Dr. Walker said he had met with the same difficulty in firing continuous gum cases, using Verrier's muffles. He would suggest that the bad results were due to the unequal temperature of different parts of the furnace, and that this might be obviated by having a better supply of gas. He thought that if Dr. Cunningham would have a larger supply pipe fitted, not less than $\frac{3}{4}$ inch diameter, inside measurement, the heat would be equalized, and he would meet with no more failures of this kind.

Mr. D. Hepburn called attention to the following plan for improving the adhesion of suction plates.

All must have experienced the difficulty which was not unfrequently met with in establishing the confidence of patients in suction plates, especially when first applied. Even with the most perfect model, the most accurately adjusted arrangement will often at the first offset show no tendency whatever to adhere to the gum, and the patient may have to undergo many days of discomfort before adhesion is established. He had tried to overcome this difficulty by coating plates with various substances of an adhesive nature, in order to spare the patient a disagreeable ordeal, and he was aware that similar attempts had been made by many other practitioners. Thus he had tried sprinkling the plate with flour and painting it with various gums and mucilages, but with little success, most of these substances being rapidly dissolved and washed away. For about a year, however, he had employed powdered Gum Tragacanth with the most satisfactory results. Indeed, the most refractory plates, when this substance was used, would adhere with a certain amount of

tenacity, and frequently could not be dislodged without a considerable effort.

The best method of application was to keep the powder in a bottle with a piece of muslin tied over the mouth, and to sprinkle the plate with a thick layer of the powder before putting it into the mouth. The saliva would in a short time convert the tragacanth into a glutinous and almost tasteless layer which would remain for days. In obstinate cases the patients could themselves apply the powder daily, and found much comfort from so doing.

This use of tragacanth had been suggested to him by a patient of great ingenuity, and he had never met with any substance which would act so efficaciously. Having experienced its utility himself, he wished to suggest its employment, for the purpose referred to, to other members of the Society.

Mr. R. H. Woodhouse said he had found powdered gum arabic of some use in such cases, but at the suggestion of Mr. Hepburn he had lately used the powdered gum tragacanth and had found this very much better.

The Scrutators reported that they had examined the ballot papers and found that the list of office-bearers recommended by the Council had been unanimously elected. The list was as follows :—

President.

T. Charters White, Esq.

Vice-Presidents.

Resident : Messrs. George Gregson, Henry Sewill, and S. J. Hutchinson.

Non-resident : Messrs. Richard White (Norwich), Andrew Wilson (Edinburgh), and Richard Rogers (Cheltenham).

Treasurer.

James Parkinson, Esq.

Librarian.

Felix Weiss, Esq.

CURATOR.

Storer Bennett, Esq.

EDITOR OF THE TRANSACTIONS.

Frederick Canton, Esq.

HONORARY SECRETARIES.

Messrs. David Hepburn (*Council*), Robert H. Woodhouse (*Society*), and Willoughby Weiss (*Foreign Correspondence*).

COUNCIL.

Resident Members: Messrs. W. St. George Elliott, Augustus Winterbottom, Samuel Cartwright, Morton A. Smale, J. Howard Mummery, Arthur S. Underwood, C. G. Boyd Wallis, E. G. Betts, and J. F. Corbett.

Non-resident Members: Messrs. W. E. Harding (Shrewsbury), Robert Reid (Edinburgh), J. R. Brownlie (Glasgow), J. H. Whatford (Eastbourne), F. H. Balkwill (Plymouth), and George Brunton (Leeds).

The PRESIDENT then called upon the Treasurer for his Annual Report.

MR. PARKINSON said the report he had to present was satisfactory except in one respect, viz., that there had been a slight falling off in the numerical strength of the Society. The total receipts during the year ending October 31st, 1885, had been £513 13*s.* 5*d.*, whilst the expenditure had amounted to £426 19*s.* 10*d.*, leaving a balance in hand of £86 13*s.* 7*d.* The assets of the Society at the end of the financial year amounted to £2,580 1*s.* 10*d.* Twelve new members had been elected during the year, whilst there had been seven resignations, five deaths, and three names had been removed from the list on account of non-payment of subscriptions—a loss of fifteen in all. The Society now consisted of 315 members, viz., 121 resident and 194 non-resident members, besides 43 honorary and corresponding members. The number of members in 1883 was 333; in 1884, 318; and in 1885, 315; the falling off this year was but slight, still it was continuous, and he should be glad to see a larger proportion

of the young men who were now entering the profession joining the Society. He hoped members would do their best to make the advantages of the Society known to all who were eligible.

The usual tabular statement is subjoined.

The Treasurer in Account with THE ODONTOLOGICAL SOCIETY OF GREAT BRITAIN,
for the Session ending 31*st October*, 1885.

DR.	£	*s.*	*d.*
To Annual Subscriptions	400	1	0
Entrance Fees	28	7	0
Arrears of Subscriptions	10	10	0
Sale of "Transactions"	7	13	6
Sale of Museum case	8	8	0
Interest on Stock	39	9	9
Interest on £550..	17	17	6
Interest on Deposit	1	6	8
	513	13	5
Cash at Bank and in Treasurer's hands, &c., 31st October, 1884	565	16	0
	£1,079	9	5

CR.	£	*s.*	*d.*
By Printing and Publishing the "Transactions"	92	11	7
Postage of "Transactions"	13	13	6
Sundry Printing	26	5	6
Woodbury portraits	9	18	0
Reporting	20	0	0
Rent (one year)	105	0	0
Refreshments	24	8	0
Library	22	14	5
Museum	31	10	0
Postage (Society)	8	16	10
Purchase of Stock	39	9	9
Sundry payments	32	12	3
	£426	19	10

Examined and found correct, *January 7th*, 1886.

F. H. WEISS,
CHARLES TRUMAN, } *Auditors.*

T. CHARTERS WHITE, *V.P.*, *Chairman.*

	£	s.	d.
Gross Receipts	513	13	5
Gross Disbursements	426	19	10
Surplus over Expenditure	£86	13	7

Assets of the Society, 31*st October*, 1885.

Stock, New Three Per Cents.	1,377	12	3
Cash at interest	550	0	0
Cash at Bank, and in Treasurer's hands, &c.	652	9	7
	£2,580	1	10

New Members elected (1884–85)—		Total.
Resident	5	12
Non-Resident	6	
Honorary	1	
Resignations—		
Resident	3	7
Non-Resident	3	
Honorary	1	
Deaths—		
Resident	1	5
Non-Resident	4	
Removals—		
Resident	3..	3
Members in arrear—		
Resident	8	33
Non-Resident	25	
Number of Members—		
Resident	121	315
Non-Resident	194	
Honorary and Corresponding	43..	43

Mr. Weiss reported as follows :—

"It is with increased satisfaction I continue to report the usefulness of the Library. We have had a larger number of borrowers in the past than in any previous year; 55 members have availed themselves of the privilege of having books, and 80 students have taken advantage of the liberality of the

Council. The additions to the Library by purchase consist of 65 volumes, while the exchanges and books presented raise the number to 100. During the present session we hope to be able to prepare an entirely new catalogue, as the printed list is very imperfect, although it should be mentioned that Mr. Camps, who acts as Sub-Librarian with great industry, has a list of every book in our possession."

Mr. Weiss also acknowledged the receipt, since the last meeting, of a work by Dr. V. Galippe, "On the Physical Properties and Chemical Constitution of the Teeth," together with the last numbers of the "Proceedings of the Royal Society" and of the "Journal of Anatomy and Physiology."

The Curator (Mr. S. J. Hutchinson) presented the following report:—

"I have now to offer, not only some account of the work of our Museum during the past year, but in a measure to give a summary of the five years during which I have held the responsible post of Curator, which post I have now felt it wise to resign, on account of the pressure of other duties upon me. The Museum in 1881 contained a vast number of interesting specimens which were not contained in the previous catalogue, and it was necessary to arrange, classify, and number those specimens; in this work, and in the preparation of the catalogue, I had the valuable assistance of the Messrs. H. and W. Weiss.

"I wish to take this opportunity of expressing our great regret that many interesting specimens were entered in the catalogue without the names of their donors. This arose in a great measure from the great accumulation of uncatalogued specimens, and from the absolute impossibility of identifying the donors in the absence of any name or other mark upon their gifts. It was thus that the collection of numerous very valuable and instructive specimens lent to the Society by Mr. Samuel Cartwright were in great measure catalogued without his name being attached. I am glad, however, to report that Mr. Cartwright has generously changed his loan

into a gift, and the Society is thus to be congratulated upon having absorbed into its collection this very handsome addition. Mr. Cartwright has also given a large and handsome specimen-case, of which the Society has long had the use, and has promised to send the lower jaw of a sperm-whale.

"I have also to express my regret that certain specimens presented by Mr. Andrew Wilson of Edinburgh, Mr. De Lessart of Aberdeen, Mr. Crowther of Wakefield, and I am afraid some other members of the Society, have not had their donors' names duly acknowledged. It is satisfactory to note that there is not a single specimen in the supplementary catalogue which I issued in 1884 which is not duly credited to its donor; and I am glad to be able to do this, as it is only right that members who take the trouble to collect and give specimens should have them properly identified. With regard to the Museum itself, some change has been made by moving a large portion of the 'Comparative Anatomy' series into one of the rooms of the Dental Hospital proper; but it must be admitted that the very limited and crowded space allotted to our Museum prevents a satisfactory exhibition of the many treasures we possess. Our collection of specimens illustrating Comparative Pathology has been enriched by the many valuable donations of Mr. Bland Sutton, and I would like also to mention the names of many other donors, but to do so would take up more than the space allotted to me.

"We have also bought some very interesting gorilla and other skulls, besides separate fossil and other teeth. A new feature has been introduced by Mr. Howard Mummery, who has very kindly taken a series of photographs of a certain range of specimens, and he proposes to print a certain number to illustrate a few copies of the catalogue, which will be of immense value for purposes of reference.

"The past year has been one of very great activity in the matter of donations to the Museum; in fact, nearly a hundred specimens have been added, some of them of the greatest interest. This number compares very favourably with the three years previously, in which only 125 had been added.

"In conclusion, I must be allowed on my own behalf to thank most sincerely all those members who have sent me specimens, and in handing over my trust to Mr. Storer Bennett, I feel sure our Museum will be in most efficient and competent hands."

The PRESIDENT then proceeded to deliver the following Valedictory Address.

VALEDICTORY ADDRESS

By C. Spence Bate, F.R.S.,

On Quitting the Presidential Chair of the Odontological Society.

Gentlemen,

The time has now arrived when it is my duty to resign the position with which I have been honoured for the last twelve months. It is the highest professional distinction that any man can hope to attain, and one of which he should needs be proud, viz., to be the President of a Scientific Society, the object of which is the elucidation of practical and theoretical phenomena connected with the profession of which he is a member.

The Odontological Society has in the past done much to bring its members together in the bonds of friendship, particularly amongst those who are ever students and insist on progress.

One of the greatest hardships that the followers of the dental profession have had to contend against is the want of knowledge and general appreciation of the value of the organs which they study.

A strong illustration of this is exhibited in the order issued by the Board of Admiralty to its medical officers—that no lad shall enter Her Majesty's navy who has lost more than five teeth.*

* The following is an extract from the Admiralty Regulations referring to this subject :—

"When on examination for entry five teeth are found to be absent or unsound, instead of the candidate being absolutely rejected, his case should, if he is considered in other respects a desirable candidate, be referred on Form 8.—508, the number, description, and situation of the

The age at which a lad enters the service is about fourteen years; at this time he has all his teeth in a forward condition, excepting the four last molars. Assuming that his teeth are sound he has a practical set of twenty-eight teeth in a forward state of development.

The condition of a lad's mouth at this age is that, although the teeth may be sound, the jaws in a large proportion are contracted, the teeth are frequently crowded and compressed, the larger and finer the teeth the more intense may be the irregularity, so that the loss of two teeth in each ramus of the jaws may frequently be found desirable to allow room for those that remain to be able to stand in the line of an even arch.

It is not infrequent that we find the four first molar teeth hopelessly riddled with decay at a very early age, and if they should be removed before the second molars have protruded themselves through the gums, the position they once occupied can in the adult mouth only be determined by experienced observation. Should the teeth anterior to these be irregular, the two first bicuspids might be removed, and in exceptional cases, when the arch is narrow, the lateral incisors might also be extracted, and yet the dental arch be retained in its even regularity.

Thus occasionally six teeth, and not infrequently four, might be judiciously removed from each of the jaws, with advantage to the future healthy condition of the mouth, and the permanent utility of the teeth improved.

Thus eight or twelve teeth might be removed from the mouth, and the person gain by the loss; while on the other

deficient or defective teeth, as well as the condition of the others, being accurately stated.

"(*b*) In the case of newly entered boys sent for survey to a Naval Hospital on account of defective teeth, the surveying officers shall pass or reject the candidates, using their own discretion as to the disqualifying nature of the disability."

hand four teeth only might be lost, and the set made weak as a masticating organ. For instance, the loss of the two first molars from the lower jaw and the two second from the upper, or the four molars from either jaw, would not exclude a lad from entering Her Majesty's navy, while he who lost two lateral incisors and four bicuspids, that is, six teeth, would be excluded. The lad who lost the four non-corresponding molars would have a feeble organ of mastication, whereas he who lost the six above mentioned would have an improved apparatus, as might also he in whose mouth there was an abnormal degree of irregularity, if under experienced knowledge, six, eight, or more teeth were judiciously extracted. The stringent rule of the Admiralty thus excludes many good lads from serving in Her Majesty's navy, whilst their places may be taken by others with less efficient dentures, although in healthy appearance they may come up to the Admiralty standard.

Experience, moreover, teaches that many youthful mouths in which regularity and promise of beauty exist, will, if neglected, exhibit in a few years the signs of interstitial decay, the incipient stage of which is only apparent to trained and careful observation. This fact, so frequently demonstrated in the lives of the middle and upper classes of society, where much thought and care is taken of the teeth, must be largely aggravated in the class from which our navy is recruited.

This liability is due to the close contact of large and well-formed teeth in jaws scarcely large enough to hold them—a characteristic that is frequently only made apparent in the defective form and irregular position of the last tooth developed. I mean the *Dens sapientiæ*. In such mouths a liberal and judicious extraction of the weaker teeth, in the earlier stage, while the disease is yet of an incipient character, would remove the lateral pressure which produces the conditions that induce decay.

If, however, such a system were pursued towards a lad who was a candidate for the navy, he would be excluded from entering that service if he had lost more than five teeth, no matter how unimportant those teeth might be.

It must be remembered that I am speaking of youths who have never heard of a tooth being plugged or treated in any way excepting by extraction, the consequent pain of which defers the operation until the pain it causes appears relief to the suffering that is being endured.

The teeth of this class are generally neglected and allowed to overcrowd each other to a great extent, and the consequence is that the germ of future injury to the teeth is induced by the want of a judicious weeding.

Nor is decay the only trouble likely to arise from the existence of a crowded denture.

Lateral compression is the source of much distress, and often the source of obscure pains in the teeth themselves, as well as being the cause of neuralgic affections. This is more or less frequently illustrated in the irregular position of the third molar tooth. The troubles that arise from this ill-developed organ are, I believe, mostly due to the cramped position in which it is constantly found, and which, I believe, would be largely reduced by the removal of the first molar, wherever the latter is decayed, prior to the development of the second molar tooth.

There is another disease that has of late years been drawing the attention of our profession, the study of which will yet require considerable and extensive observation before we can be supposed to have arrived at a conclusive theory of its true nature and origin.

I mean that tendency for teeth under certain obscure conditions to become loose and fall out while yet in a healthy state, long before their value as masticating organs is impaired or their work done. Sometimes, whatever the disease may

be, it is found to attack one or more teeth, and these not in approximate position to one another; again it will be found to attack all the teeth in one jaw and none in the other, and sometimes all the teeth in both jaws, occasionally sparing one or two which seem to withstand the disease, but succumb at last to the general loss of osseous support rather than from the progress of the disease itself.

For several years attention has been given to this affection, and observations pursued that bear more or less immediately on it, with a desire to ameliorate the distress when it occurs.

Unfortunately the disease is brought to our knowledge when it has advanced too far to do more than to ameliorate, and the removal of the teeth affected is the immediate or not long deferred result.

Inspection of such a set will show, when the disease is defined and well pronounced, that the gums are red and swollen, the gingival processes are large, loose, and protruding above the natural margin to an extent that sometimes equals the height of the teeth which they surround. If these gingival processes be laid back the teeth will be found, according to the length of existence or virulence of the disease, to be separated from the gums to a more or less considerable degree, and along the exposed surface of the tooth granular masses of hardened calculus will be found attached to the root, with an adhesion that is astonishingly secure. Within the pockets formed by the enlarged gum growth around the loosened teeth, there is a fluid that much resembles pus in appearance, but which when placed under the microscope is seen to be of very different construction.

This fluid is found to contain a mass of fungus germs of the bacillus and micrococcus type, which frequently exist in such an active condition that they swim in the field of the microscope in wavy lines like young tadpoles. Attached to surfaces the form attains a rod-like condition that grows to a con-

siderable length; these break into smaller lines and multiply accordingly, but whether, as I believe, they originate in the smaller micrococci I cannot say.

Now if we turn to another source of examination, we shall find a similar supply of material under other and separate conditions.

On the surface of an artificial substitute that has been worn in the mouth of a person who has not taken any remarkable degree of care of the same, we shall observe that at certain spots an accumulation of material takes place; if this be removed a more or less adhesive condition is found to exist between the material there lodged and the plate on which it rests. If the former be removed it will commence to grow again, and this takes place either on gold or vulcanite, and it produces a mark on the surface of the plate. It commences generally in small round spots which gradually enlarge in height and diameter.

Microscopic examination of these several spots shows their resemblance to the deposits formed within the gingival pockets at the base of the teeth. This, I think, clearly demonstrates that both these conditions are obtained from an external source, and that in both it is the same. Although not in the same active condition, they exhibit the stationary rods and active and wandering bacilli and micrococci mixed with them.

Although the presence of these fungus germs may be the active agent of the inflammatory state that induces the absorption of the alveolar margins, yet the early conditions which enable these foreign bodies to establish themselves and thrive must be looked for in a more distant stage, and have relation to the constitutional character of the tissues. I must ask now those who follow me to accept for the present the conclusiveness of my observations, and if their experience hitherto does not induce them to accept mine at once, that

they will be good enough to defer their judgment until they have had time to compare my conclusions with their own opinions before arriving at a distinct theory on the subject.

I believe that lateral compression is the predisposing cause of that distressing condition that leads to the waste of the alveolar processes. The jaws not being large enough to allow the teeth to range themselves in their normal position, the teeth stand crushed together in almost every form of irregularity, some within and some without, and others elevated above or depressed beneath the normal line of the dental arch.

One of the commonest and most prevailing instances may be frequently observed in the lower front teeth. The lower jaw being small, the canines, the strong fronto-lateral buttresses of the jaw, are situated too near each other to allow the four incisors to stand in the normal arch between them; the consequence is that pressure forces the incisors above the level of their correct position and ranges them like a fan, spreading from a common centre. If they do not rise above the level of the others, it is because they have been forced out or in beyond their normal line; in either case the tooth becomes marked for an early attack that ends in its becoming loose and falling out.

I do not think that I can illustrate better the cause and progress of the disease than by recording the history of a mouth in which several sound and healthy teeth can be traced to have loosened and been lost as a direct consequence of lateral pressure.

The mouth to which I refer I have had the opportunity of a more or less constant revision for many years. The teeth were sound, healthy, and strong. Three or four were plugged with gold in their buccal and coronal surfaces, but the stoppings were small and protective rather than restorative.

The teeth were all regularly developed in an even arch

excepting the right upper central incisor, which had to be turned by mechanical contrivance. This state of things continued until the third lower molars appeared, and then a change came on that may best be understood by the following account.

The lower wisdom teeth were cut when the patient alluded to was twenty-two years of age; the first came through with much distress and some pain, which latter was felt chiefly between the second bicuspid and the molars on the same side.

My advice was—and I much regret that it was from some cause not carried out—the removal of the newly developed tooth.

The pain between the above-mentioned teeth, though not severe, was frequent, and often present for many days at a time, and latterly in connection with a similar distress corresponding in position with the first bicuspid on the same side.

These pains were evidently between the teeth and not in them, as the teeth were not tender to the touch; but the interdental gingival processes were sensitive and suffered distress from the presence of food, and the teeth generally were tender to mastication.

A year or two after the wisdom tooth on the right side came into position, that on the left followed with more local and immediate, but with less general and continuous disturbance.

With this latter tooth a phagedenic ulcer spread over the inside of right cheek, palate and fauces, and for several days the erysipelatous symptoms were severe and acute, and were chiefly reduced by a lotion of the bichlorate of potash.

When this condition of things subsided, the mouth for a time was apparently well; but whenever there was any gastric disturbance the gums became irritated and the teeth tender in biting, and occasionally the disturbance would increase to a distressing degree.

The gentleman not consenting to have the wisdom teeth removed, I remember passing a file between the first molar and second bicuspid teeth on the right side—(I am writing of forty years ago)—and procured for my friend a relief that was decided in degree and permanent in its durability.

Time, however, obliterated the space cut between the teeth, and although the disturbing pain never returned to the same extent, a new and different condition of things arose. The wisdom teeth came better into place, but it was found that the upper incisor teeth were being projected forward by the pressure of the lower incisors against them, causing teeth that were once in close contact to be forced apart to a considerable extent. At the same time the gums corresponding with the position of the lower incisors exhibited evidence of becoming thickened and disturbed.

It now began to settle on my friend's mind that it would have been better had the wisdom teeth been removed earlier.

This was now done, and for several years all trouble disappeared; the teeth were strong and healthy, and with the exception of the second bicuspid on the right side that had been filed, no symptom of decay was visible.

It will be remembered that the chief distress fell on the molar teeth of the lower jaw and between the bicuspid and canine on the right side. Now the history culminates in this point, that all the teeth that suffered most from lateral compression became loose and fell out. The alveolar processes corresponding with the second molars, and the inner and outer alveolar walls of the first molar on the right side, wasted away, as well as the outer wall of the bicuspid alveolus.

I think any one who has followed me will agree that had the wisdom teeth been removed when it was first proposed, much of the later condition of things would have been arrested, and I think that we are justified in tracing, as cause and effect, the loss of these teeth to the action set up by the presence

of teeth in a jaw too small to retain them without considerable lateral pressure.

If we follow up this by observations under other and different conditions, we shall remember how in the irregular position common to the lower incisor teeth we see one tooth forced outward and another too far back, how the too advanced teeth lose their hold on the adjoining tissues through the absorption of the alveolar walls, and how, on the other hand, a large fold of the gingival margin fills up the hollows caused by the retiring teeth, and forms pockets into which the saliva penetrates, holding in solution calcareous salts and fungoid germs.

The tartar never deposits on soft and living tissue, but rests only on the hard and fixed structure of the teeth, following closely on the separation of their vascular attachment. These fungoid germs, which we recognise under the names of Micrococci and Bacilli, induce an active local inflammatory condition of the gums that is followed by the absorption of the alveolar processes, the wasting of which removes from the teeth that support which their presence gives. The teeth become loose, and in a short time become useless as masticatory organs and fall out. That we may be able to know and trace the pathology of the disease is to enable us to arrive at a correct method of treatment upon a scientific basis.

At present our treatment is empirical, and therefore only remedial. We may scrape the salivary calculus from the teeth, sponge and syringe the softer tissues with any specific we like, but we only reduce the action and do not remove the source of the disease.

No doubt but that topical treatment does relieve trouble and reduce the activity of the disease, and when thoroughly carried out with the cordial support of the patient, the value of the teeth may be retained as useful organs fulfilling their capacity for some time longer.

The true origin of this disease is to be found in the great lateral pressure that is induced by the teeth being larger in proportion than the space in which they are arranged, which is, I believe, the beginning of those conditions which enable the germs of the disease to take root.

In a young person we find the vascular folds of the gum often very conspicuous, a condition that is not present when the teeth are duly spaced. If I am correct in this belief, our treatment must be preventive rather than curative, and in those mouths in which it is more desirable that the teeth should be useful than ornamental, it is important that undue crowding of the teeth should not be permitted.

Thus in the treatment of the teeth in the class from which our military and naval forces, as well as the industrial occupations generally, are recruited, it is the duty of those who have the management of the same rather to secure a healthy denture than to seek to retain those teeth that are conventionally ornamental; and if in any situation in life it is desirable that none should attain a footing in it without a normally good set of teeth, it is still more important that such individuals should have their teeth under regular supervision during the time that the dentinal tissues are becoming consolidated and are less liable to resist conditions that are injurious to them.

If a boy enters the navy at fourteen years of age with a model denture in form and healthiness, it by no means follows that the teeth will retain those conditions if treated with neglect. It therefore appears to me that it is as important that the mouths of the boys that enter the navy should have that supervision which is necessary for their permanent healthiness, as it is necessary to fix an arbitrary rule prior to their entering the service as to the number of teeth they may possess.

The question arises, how is this supervision to be attained?

I can only suppose that if it be an important feature in a sailor's life that he should possess a good set of teeth, then it is desirable that the medical staff of that service should be educated in the knowledge of the organs, and it should be their duty to attend to them. And we might suppose that on board a ship of war, where there may be five hundred to a thousand men, the L.D.S. Diploma of the Royal College of Surgeons would be of greater practical value than the Midwifery Diploma of the same College, yet the latter is, I believe, a compulsory qualification.

Nothing can conduce more to the risk of a ship, or the loss of an important strategic position, than a sailor in a night watch, or a soldier on guard, suffering from the most acute of known pains, such as is producible from diseased state of the teeth.

And when we consider the importance that the wealthy attach to their teeth, the large amount of money and time that they bestow on them, I think that we may give a thought to our poorer fellows who have to bear the brunt of storms and wars, and urge that those who are trained to look after their general health shall be educated to treat the teeth as much as the other organs of the body; and I feel assured that it will be found that many of the neuralgic pains more or less immediately connected with the teeth, and the dyspeptic condition of many a man, would disappear if the naval and military surgeons had the Diploma of Dental Surgery as well as that of Midwifery.

In the early portion of this address I said that the Odontological Society had done much good in bringing together the members of the profession; but I think that more might be done.

To know a great or a good man is to follow and emulate him. To know personally those of our profession whom we acknowledge as being greater than ourselves is to try to be nearer to them.

For this purpose members come to this Society and listen to communications of educational interest and practical value. But many who come from a distance listen to what has been read, and that which has been brought out in discussion, and they see many of whom they have heard;—the meeting breaks up and they return home with an increase of information, but with a feeling of disappointment; for those to whose acquaintance they had aspired may have brushed them with their coat as they passed, but still to them they are only as brilliant lights, while they are still in the shadow.

If once in the course of the year, when the season is bright, and London is pleasant, the Society were to have a reunion or conversazione, where the members might meet and know one another, where each might select and ride his own peculiar hobby, the members would learn by a knowledge of each other to respect and appreciate each other, and in my humble opinion the Society would increase in numbers by bringing from the more distant parts of the country those who desire not to be lost in the isolation of obscurity.

Before closing these few remarks I should like to express my indebtedness to the Council for being so lenient to my shortcomings, and to the two Secretaries, Mr. R. Woodhouse and Mr. D. Hepburn, for their obliging attention in overcoming difficulties that would have arisen but for their experience and attention.

Votes of Thanks.

Mr. Browne-Mason (Exeter) said he had been asked to propose a resolution, and the applause which had just followed the conclusion of the President's Address convinced him that the task he had been called upon to perform was not an unpleasant one. He moved that the thanks of the Society be given to Mr. Spence Bate for the able and efficient manner in which he had conducted the business of the Society during his year of office as President. The Society was honoured by having as its President a gentleman so distinguished for his scientific attainments. It was, however, quite unnecessary for him to enumerate Mr. Spence Bate's claims to their regard, and he would therefore content himself with formally moving the resolution.

Mr. Gregson said he had great pleasure in seconding the resolution. A few years ago the Society had endeavoured so to amend its rules as to become in reality, as well as in name, the Odontological Society of Great Britain. It was to this alteration that they were indebted for the honour of having Mr. Spence Bate as President, and he thought it was a very good thing for the Society that country members were now eligible for the Presidential Chair.

The resolution having been carried with applause, Mr. Spence Bate briefly expressed his acknowledgments. It had given him great pleasure to occupy the position he was then about to vacate. As for the change in the constitution of the Society referred to by Mr. Gregson, he knew that some doubts had been felt with regard to it, but he trusted that the interests of the Society had not suffered during his year of office, and hoped that the plan would work well in the future.

Dr. Walker moved that the thanks of the Society be given to the Treasurer, Librarian, Curator, Editor of the Transac-

tions, Secretaries, and to the other members of the Council for their services during the past year. The best thanks of the Society were due to all its officers, but he would specially mention the Secretaries. No one who had not himself acted as Secretary could possibly form any idea as to what their work was like. Messrs. Hepburn and Woodhouse had discharged their duties most efficiently, and he was glad to see that they had consented to act for another year. He was sorry that they were about to lose the services of Mr. Hutchinson as Curator, a post which he had held for five years. During that time he had completely reorganized the Museum, which was now most admirably arranged, and the special thanks of the Society were due to him on his retirement.

Dr. Cunningham seconded the motion. He fully endorsed all that Dr. Walker had said respecting the claims of the office-bearers to the gratitude of the members generally; he fully appreciated their labours, and, as representing the country members, returned them hearty thanks.

Mr. Parkinson briefly replied for his colleagues and himself. No Society could go on properly unless it was possessed of officers who had put their heart in their work, and the fact that such was always to be found amongst its members said much for the vitality of their own Society.

The President then announced that at the next meeting, which would take place on Monday, February 1st, Mr. Bland Sutton, F.R.C.S., would read a paper on "Dental and Oral Cases in Animals."

The Society then adjourned.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

February 1*st*, 1886.

T. CHARTERS WHITE, M.R.C.S. & L.D.S.Eng.,
President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

The President announced that the following gentlemen had been duly nominated as candidates for membership, and would be balloted for at a subsequent meeting, viz. :—

Messrs. Charles Moulden Bayfield, L.D.S.I., 9, Talbot Road, Westbourne Park, W., and
Charles M. Cunningham, D.D.S.Michigan, 2, King's Parade, Cambridge.

The following candidates were then balloted for and elected members of the Society, viz. :—

Messrs. Peyton Grenville Lavason, L.D.S.Eng., 12, Bridge Street, Hereford;
J. Charles Storey, L.D.S.I., 9, Regents Terrace, Anlaby Road, Hull;
Walter Harrison, L.D.S.Eng., D.M.D.Harvard, 98, Western Road, Brighton; and
Morgan Hughes, M.R.C.S., L.D.S.Eng., 4, Wellesley Villas, Croydon, as non-resident members; together with
Henry John Kluht, L.D.S.Glasg., 44, Norfolk Terrace, Bayswater, W., as a resident member.

Mr. Weiss announced that Dr. Magitot, of Paris, had forwarded as a donation to the Library, by the hands of Dr.

Harlan, copies of several works and reprints of articles lately published by him, including the article "Dent" from the "Dictionnaire Encyclopédique des Sciences Medicales," vol. xxvii, "Recherches sur l'Evolution du Follicule Dentaire," "Les Lois de la Dentition chez les Vertebrés," "Etudes cliniques sur l'Erosion des Dents," and several others. He had also to acknowledge the receipt of the Calendar of the Pharmaceutical Society for the current year.

Mr. Storer Bennett reported that he had received three photographs, kindly taken by Mr. Charters White, of the microscopic sections of the fractured and re-united tooth which had formed the subject of a communication from Mr. Dunn, of Florence, read at the November meeting. A copy of one of these is published with this number of the *Transactions*.

Mr. Arthur Underwood submitted for examination two cases of replantation.

The patients were two girls about eleven years of age, and about fourteen months had elapsed since the operation. In one case a lateral and in the other a central had been extracted on account of irregularity, and immediately replaced. In each case the operation succeeded without a bad symptom; there was no tenderness after forty-eight hours, and the teeth soon became quite firm. The roots were not quite fully calcified.

He believed, and he would give his reasons for this belief, that these teeth had living pulps, and therefore that teeth, if only removed from their sockets for a short time and replaced, need not necessarily be devitalised. No one doubted that a replanted tooth regained a certain amount of vitality by means of the re-united periosteum, but most denied that the nervous and vascular connections of the pulp could be re-established through the apical foramen, asserting that this was impossible owing to the small size of the aperture. But as the process of union was microscopical, it was evident that the size of the foramen could not be an

Description of Plate.

Mr. Dunn's case of fractured and re-united tooth.

The specimen is a very interesting one; the fracture, which had taken the direction of the line XX, occurred after a considerable portion of the crown and root had become calcified, as evidenced by the direction of the dentinal tubes, &c.

Fig. 1 represents the whole tooth with the line of fracture marked X X.

Fig. 2 is an enlarged view of the fractured portion, which has been repaired by secondary dentine B′, B′.

It will be noticed that the fracture passed through the enamel separating two portions A, A′ by a considerable interval from each other, the space being filled up by secondary dentine.

In the smaller figure the cementum may be noticed to pass *under* or *inside* the enamel at D. The fractured portions at this part were apparently impacted, and no doubt fresh cementum (for it is here very thick) was produced, forming a sort of callus to knit the portions more firmly together during the subsequent process of repair.

Fig. I.

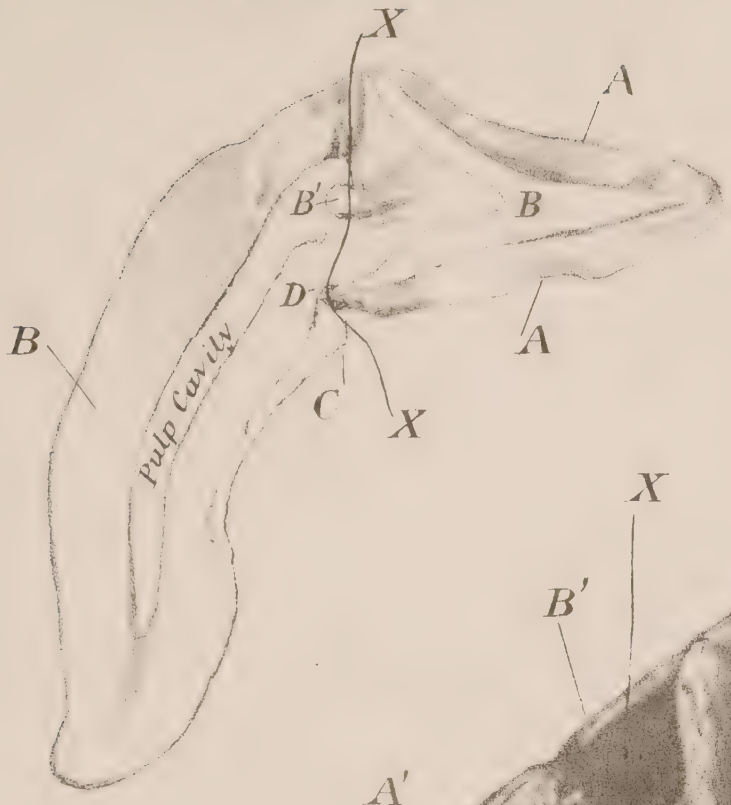
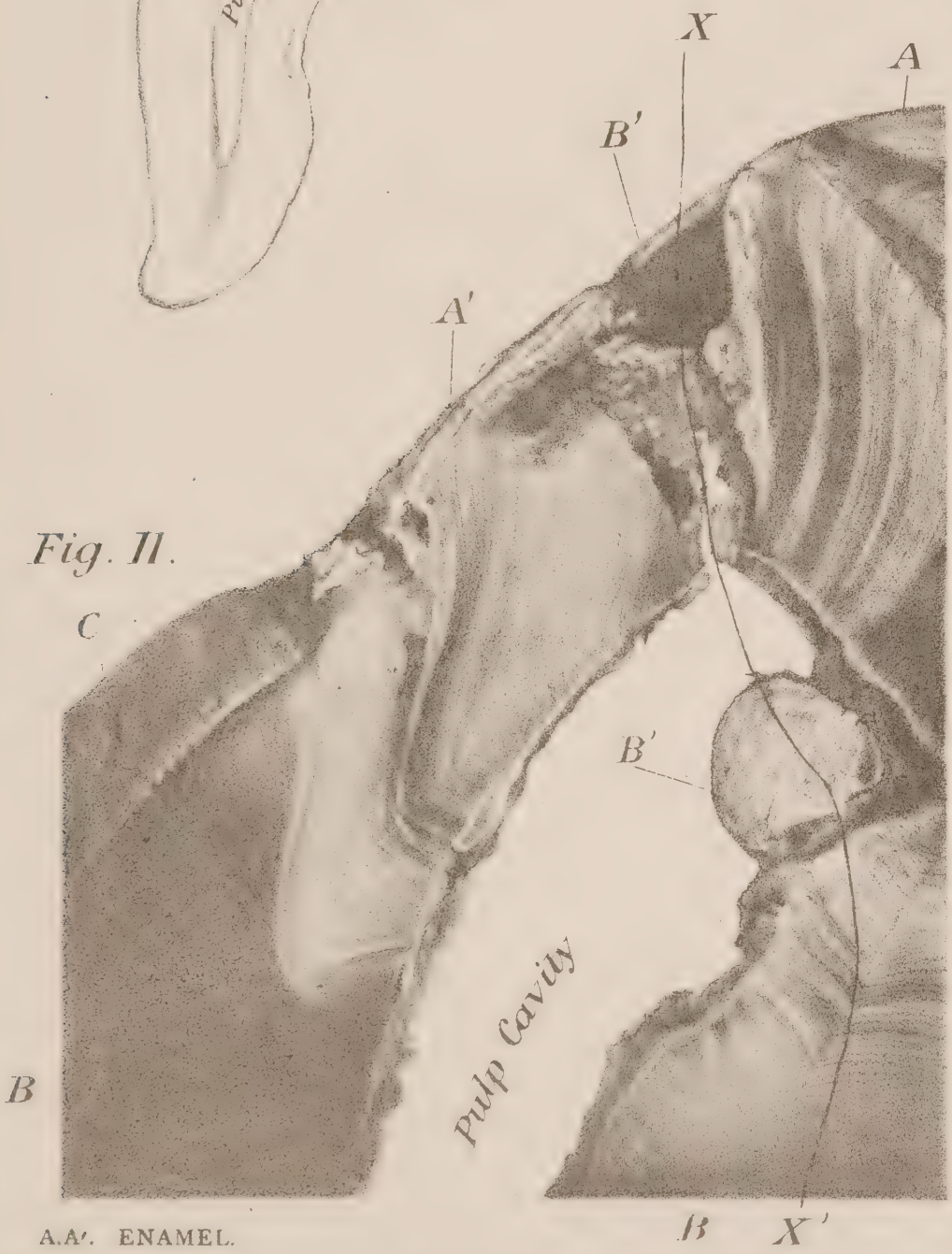


Fig. II.



A.A'. ENAMEL.

B. DENTINE.

B'. SECONDARY DENTINE.

C. CEMENTINE.

D. DIPPING OF CEMENTINE UNDER THE ENAMEL.

X.X'. LINE OF FRACTURE.

HARRISON & SONS, LITH. ST. MARTIN'S

obstacle, whilst a consideration of what took place under similar circumstances in the case of other organs of the body rendered the statement he had made still less improbable. Thus, if a portion of skin was removed with its vessels and replaced, it would re-unite; so also a divided nerve would re-unite and its function be re-established. And if this could take place in other organs, why should it be impossible for the vessels and nerves of a tooth which had been extracted and replaced to re-unite?

He maintained that this had taken place in the cases now shown. If the pulp had died, the teeth would have become discoloured. This discoloration was due to a change in the contained blood, and since the tooth of a young person was more vascular than that of an old person, a greater amount of discoloration might have been expected in these patients on account of their youth. The discoloration was generally more marked after sudden death of the pulp than when this occurred after a period of disease. A marked change of colour might therefore have been expected in these teeth; but instead of this their colour was exactly the same as the other teeth; it was impossible to detect the slightest difference. The sensibility to heat was also precisely the same; on touching them, or one of their neighbours, with a hot burnisher a sharp pain was immediately experienced, whilst in the case of a dead tooth, the pain was only felt after an appreciable interval. This difference was noticeable also when cold applications were used, but it was not so marked as with hot.

But, by the permission of the President, he was enabled to submit the teeth to a further test. On darkening the room and applying a strong light behind the teeth, it would be seen that these were transparent,—that there was not the slightest difference in translucency between the replanted teeth and those which had not been interfered with. In order to show the difference he had a patient present who had a dead tooth, and it would be noticed that it was decidedly less transparent than its neighbours,—presenting

a cloudy appearance,—whilst a spot of caries was at once detected by its opacity.

The lamp he was about to use was one supplied by Messrs. Ash, the flame of which was enclosed in a metal chimney which had only one aperture admitting a narrow glass tube curved at the further end. The light travelled along this tube to its extremity, and could be directed at will upon any point in the mouth. It was fully equal, if not superior, in power to the electric light, being sufficiently powerful to render a tooth and even the alveolus fairly transparent, and was, owing to the entire absence of heat, very comfortable to the patient.

He would remark, in conclusion, that he was not an advocate of replantation, preferring torsion whenever this would answer the purpose; though in the case of laterals, owing to the flattened shape of the root, torsion could not usually be performed satisfactorily.

The patients having been brought in and examined,

Mr. Chas. Tomes said he had been told by Dr. Morrison, of St. Louis, that one of his assistants having replanted a tooth without removing the pulp, and afterwards feeling doubtful as to the result, drilling into it and found the pulp to be living. Mr. Underwood had suggested that the discoloration of dead teeth was due to staining by the altered blood of the pulp. He could only say with reference to this that the removal of the pulp did not always prevent discoloration. Thus, a boy was brought to him who had had a front tooth knocked out some hours before, and had carried it about in his pocket. Mr. Tomes removed the pulp, which came out entire, the root not being quite fully calcified, filled the pulp cavity with oxychloride of zinc, and the apex of the canal with gold, and replanted the tooth. The operation was perfectly successful, except for the fact that the colour of the replanted tooth was far from being satisfactory.

Mr. Quinby (Liverpool) said he could give another case to show that colour was not a very reliable test. A tooth

which had lain on a dusty road for three hours was replanted by a country doctor without any of the usual precautions. Nevertheless it became quite firm, *kept its colour*, and remained useful for six years. At the end of that time it began to be troublesome, and in spite of careful treatment had at last, nine years after the accident, to be extracted. A considerable portion of the root was then found to be absorbed.

Dr. Walker stated that fourteen years ago he extracted and replanted a lateral for a young lady; the tooth was erupted with the lingual surface forwards, and he reversed it. The result was perfectly successful; he had seen the patient quite recently; there was no difference whatever to be detected between the replanted tooth and its neighbours, and it was only by reference to his books that he could be assured as to which tooth it was.

Mr. F. J. Bennett said he found it difficult to believe Mr. Arthur Underwood's statement with regard to the re-establishment of the connections of the pulp without further proof. In his opinion none of the tests advanced by Mr. Underwood were conclusive. Certainly firmness was no test of vitality, nor was colour, and the temperature test was also very deceptive. He thought it possible, however, that in young patients the pulp cavity might become filled with some vascular substance, not true pulp, which would grow up through the large apical foramen.

Dr. Harlan (Chicago) showed a set of clamps for use in filling split bicuspids or molars. They were reversible, so as to be applicable to either upper or lower teeth.

Mr. Stokes showed a set of rubber dam clamps made from his designs by Collins. Amongst them was a "universal clamp," designed to fit any molar; another had a saliva ejecting tube attached.

The President, having characterized these clamps as very ingenious and likely to be useful, called upon Mr. Bland Sutton to read the paper of the evening.

Dental and Oral Cases in Animals.

By J. Bland Sutton, F.R.C.S.,
Erasmus Wilson Lecturer on Pathology, Royal College of Surgeons; Lecturer on Comparative Anatomy, and Assistant-Surgeon to the Middlesex Hospital.

The object of the present communication is to bring under the notice of the Society a few examples of abnormalities and diseases of the teeth and mouth occurring in animals, and to offer a few remarks on some conclusions a study of the specimens suggests.

Growths.—Morbid growths in animals are not very common; tumours of the oral cavity other than those caused by parasites are still rarer.

An interesting example occurred in an adult tiger, of fibrous epulides connected with the gums of the lower jaw. There were in all eight of these fibrous masses. A typical example is represented in the accompanying drawing. It is closely associated with a tooth which has been imperfectly erupted, and its pedicle is intimately attached to the alveolo-dental periosteum. Microscopically they seem to be overgrowths of the mucous membrane, with a large amount of exceedingly dense and tough fibrous tissue.

The general condition of the animal's teeth was

very unsatisfactory, many of them being irregular in position, and some had their crowns partially embedded in the mucous membrane.

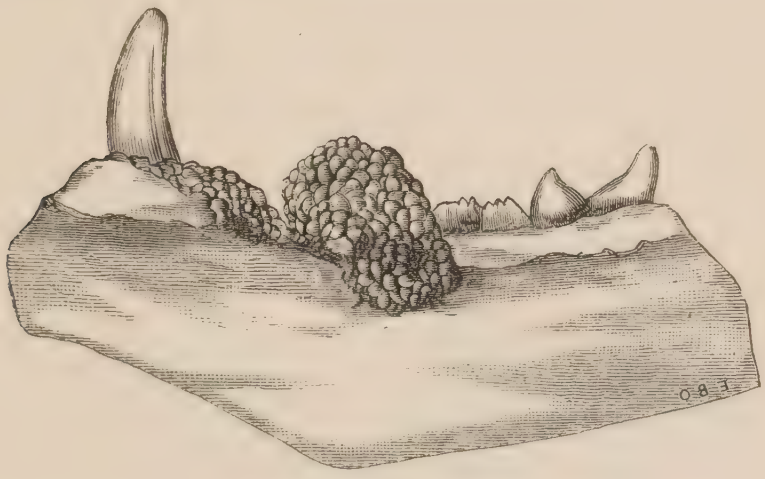


Fig. 1.—A portion of the lower jaw of a tiger, showing an epulis growing from a partially erupted tooth.

Epulis is a well-recognised affection in the horse, but in addition to the tiger, I have only seen one other example in wild animals, and that was in a wolf.

The next case is of some interest in its bearing on the relation of irritation and tumour formation.

The drawings, Figs. 2 and 3, represent a young sheep's nose surrounded by simple warts, agreeing in structure with those occurring on the hands of children. The second drawing shows the hard palate, with numerous warts sprouting from the ridges normally seen on the roof of the mouth of ruminants. A more critical examination shows that these warts are really overgrown papillæ of

which these transverse ridges are composed. In the same way numerous warts existed on the dorsum of the tongue, most of which were in connection with the lingual papillæ (Fig. 4), and the buccal fringes.

In addition to this condition of the mouth, there was a crop of exactly similar warts immediately above the hoof, at the spot known as the coronet.

FIG. 2.—The nose of a sheep presenting a crop of warts due to the irritation of stubble.

FIG. 3.—The hard palate from the same sheep.

The causation of these papillomata is somewhat curious. In this country farmers are in the habit of sowing clover among wheat soon after the young blade has made its appearance. When the time arrives for cutting the corn, the clover is low and out of harm. The wheat is removed, and allows the clover to grow, but the stubble remains.

When sheep are turned on these clover fields they have to submit themselves, at least their noses and feet, to the constant irritation of the hard ends of the stubble. In many cases a crop of warts on the nose, mouth, and coronet is the consequence.

This condition is not by any means rare, for I have heard of as many as fifty in a large flock presenting these papillomata. If the affected sheep be removed from the stubble their warts disappear.

FIG. 4.—Warts on the dorsum of a sheep's tongue, due to the irritation of stubble.

Lambs' noses, like the hands of children, are very prone to develop warts, in consequence of their fondness for sticking them in dirty places.

Osteo-dentine.—It has been remarked by more than one writer on dental subjects that it is impossible to draw any sharp line of demarcation between the varieties of dentine, for they pass by insensible gradations one into the other, and it is often difficult to distinguish between some of the varieties and true bone.

It is more especially to osteo-dentine that I wish to draw attention.

This substance is usually defined as dentine containing vascular canals with a matrix disposed concentrically around them: lacunæ may be detected among the tubules.

So far as human teeth are concerned, osteo-dentine usually occurs as a pathological formation; but in many animals, the walrus, cetacea, and others, it is found occupying the pulp chamber under conditions not usually regarded as pathological.

It seems to me that the bare fact of the existence of osteo-dentine as a constituent of teeth, under certain conditions, is really the only reason for classing this material with dentine. Between bone and dentine a very wide distinction exists. Dentine being a hard tissue pervaded in a regular manner by a system of tubules, containing fibrils of soft material. The dentine itself is the result of the activity of a layer of cells lining the pulp chamber and known as odontoblasts.

Bone, in its typical form, may be defined as a hard tissue permeated by vascular canals (Haversian) surrounded by lamellæ, containing in their midst numerous lacunæ which communicate with each other by means of canaliculi. The hard part of the tissue results from the activity of living cells known as osteoblasts. But bone may arise in other ways, and by one method which, in connection with the subject in hand, is of some importance. It not infrequently happens that tracts of osseous tissue are met with in inflammatory formations, and in new growths such as osteo-sarcomata, in which it is easy to determine that we have to deal with a deposit of granular calcareous matter in a homogeneous matrix. If the deposit is large and of long standing, the presence of lacunæ and canaliculi may be determined. A very common situation for the existence of such deposits is the choroid coat of old disused eyes.

If any one takes the trouble to compare under the microscope thin sections of bone from this situation with a piece of osteo-dentine, he will be unable to distinguish the one from the other.

Admitting the histological identity of the two tissues when fully formed, it becomes necessary to determine whether the mode of development in the two cases is identical.

I have been able to follow the matter with considerable detail in the following case.

A young Capybara came into my hands, and on examining its teeth I was surprised to find that the layers of cementum, which normally bind together the plates of its compound molars, had softened to such a degree that the various parts could be separated like the leaves of a book; in this condition it presented layers of enamel and dentine of the ordinary density, succeeded by a layer of tissue resembling tough leather; microscopical examination showed this soft tissue to be really decalcified cementum. On examining the molars carefully it was clear that one had to deal with normally formed cementum which had become decalcified, and not tissue in which the calcification had been arrested. The incisors were so soft in the parts below the gums that it was possible to mark them with one's finger-nail. On breaking them across they presented a curious porous, almost spongy, condition. The maxillæ seemed fairly normal, but the other parts of the skeleton bore evidence of disease, the knee-joints were affected with pulpy degeneration of the synovial membrane, and the body generally bore abundant evidence of malnutrition. Pieces of the incisors were slowly decalcified in a mixture of chromic and nitric acids, cut in sections, and stained in various ways. When examined under the microscope osteo-dentine could be seen in various stages of development. The first thing to

arrest attention in these specimens was the strong evidence afforded by the hæmatoxylin that many of the appearances were the result of inflammation. If sections of tissues which have been inflamed be stained with this material the inflamed portions stain more deeply and quickly than the normal tissue, hence it acts as an agent of differentiation.

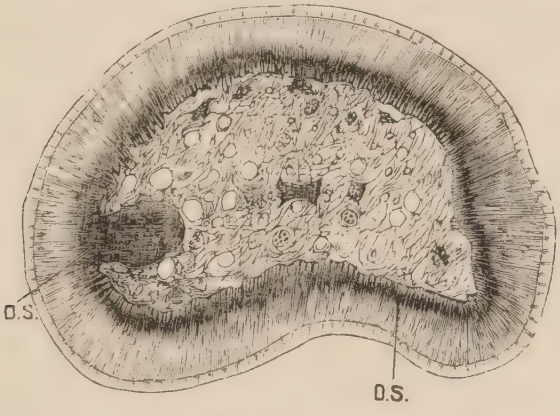


Fig. 5.—Transverse section of the incisor tooth of a Capybara, showing abnormal formation of osteo-dentine.

On examining sections of the capybara's teeth, islands and peninsulas of inflammatory tissue everywhere meet the eye, and dotted in them, in a way resembling cartilage cells, are tiny refractive calcareous granules. Beyond these patches of exudation the ordinary connective tissue of the pulp is seen. On examining a series of sections it was possible to trace the various stages from the normal connective tissue to patches homogeneous from exudation, to others sparkling with rounded refractive calcareous granules, and finally to others in which lacunæ and canaliculi could be discerned.

On comparing sections of so-called osteo-dentine with sections of bone from inflammatory new formations, I find it impossible to distinguish between them. This has led me to the conclusion that osteo-dentine is the result of ossification of the connective tissue of the pulp of the teeth: in very many cases this may be preceded by inflammation, but that event is by no means essential. Further, osteo-dentine is more closely allied to cementum than to dentine, from which it differs not only histologically, but also in the manner of its development.

If this view be correct, then osteo-dentine must be regarded as an imperfect variety of bone, originating in membrane, and in no sense allied to dentine. This opinion is supported by the circumstance that in the teeth of Odontocetes, Walrus, &c., we have no evidence of inflammation, yet osteo-dentine is present in great abundance.

Curved Teeth.—Abnormally long and curved teeth in animals whose incisors and canines grow from persistent pulps are cases so well known that they have almost ceased to be of interest. I propose, however, even in the face of this statement, to offer a few remarks on the curved and elongated teeth of the Suidæ.

The first specimen to be mentioned is a curved canine of a wild boar, lent me by Mr. Clarence Bartlett; it is represented in Fig. 6. It measures

six inches across the curve, and is fifteen inches long when measured along the outside of the

FIG. 6.—Abnormally curved tooth of a wild boar, one-fourth the natural size.

circle. A glance at the figure shows that the apex of the tooth is within three-quarters of an inch of its own pulp cavity. Judging from the appearance presented by the apex of the tooth, at least two inches of it must have been embedded in soft tissues, and had the animal lived, the apex of the tooth would have entered its own pulp. The Museum of the Royal College of Surgeons, London, possesses some examples of this kind of tooth from wild boars; there is one in particular which had been worn as a charm by some individual, which resembles my specimen in every particular except that it is not quite so large.

Mention must also be made of the remarkable specimen, preserved in the same Museum, which

was figured and described by Cheselden in his Osteographia.

This interesting specimen is represented in the accompanying drawing, Fig. 7. It is difficult in Cheselden's original drawing to make out one tooth from the other after they have penetrated the bone; and further, Cheselden's artist did not reverse the figure on the wood, which leads to more confusion.

FIG. 7.—Abnormally curved tusks of a wild boar, from Cheselden's specimen in the Museum of the Royal College of Surgeons.

In the excellent museum attached to the Veterinary School at Alfort, I had an opportunity of examining a specimen of overgrown lower canines in a boar which had been presented by M. Goubaux. This admirable specimen in nearly all points agrees

with Cheselden's specimen. We have in these examples abundant evidence that there is a great tendency on the part of the canines in this group to become abnormally elongated.

The Museum of the Odontological Society has among its treasures an interesting specimen from a Hippopotamus, where an overgrown tooth had grown in this way so that the apex had actually re-entered the pulp chamber. Other specimens of this character have been reported, but I am unacquainted with any which approach this one in the complete formation of a circle.

The point which is of especial interest to me in these cases of curved teeth is, that all members of the pig family exhibit this tendency—the boar, the hippopotamus, the wart-hog, Red River hog, and babirussa. In a paper communicated to the Zoological Society in 1885 I endeavoured to show that the curiously curved canines so characteristic of the male babirussa, which have so long been a puzzle to naturalists, must be regarded in no other light than a pathological condition which has become transmitted, so as at length to become a racial character.

We see the earliest condition in the curved upper canine of the boar, the second or intermediate condition in the wart-hog, and the most exaggerated degree in the babirussa, besides occasional examples turning up in all members of the pig family.

Just a few words about the curving of the teeth. As to the cause of this, many opinions have been held, but it is of simple explanation. Mr. Smith Turner reminded me that when the stockbreeder wishes to make the horns of the cows curl, he scrapes the inner sides with a piece of glass. As a consequence the horn curls towards the weakened side. This view is applicable to all the curved teeth I have examined, and especially to the circular teeth of the boars. The concave side of the curve always presents a worn surface where it has been played upon by the opposing tooth. Also in the case of the incisors of rodents, the constant wear of their posterior surfaces weakens them in that

FIG. 8.—A deformed tusk of an elephant, probably due to a defect in the tooth germ. (Royal College of Surgeons' Museum.)

direction, and a curve results, of which the convexity looks outwards and the concavity towards the mouth.

This curving towards the weakened side is very well illustrated in the elephant's tusk represented in the accompanying drawing, Fig. 8. In this particular case it is probable that some defect existed in the tooth germ, leading to deficient formation of the dentine, causing the tusk to become twisted into a spiral. The Museum of the Royal College of Surgeons possesses several examples of twisted teeth of this character. In all probability it is due to the transmission of some similar defect in the teeth of the ancestors of the narwhal, that causes the enormous tusks of these remarkable mammals to present the singular spiral twist so characteristic of them.

On other occasions I have exhibited before this Society examples of alveolar abscess in Kangaroos, the result of injury to their long procumbent incisors. The following is an additional specimen :—

A Hypsiprymnus broke the apices of its two lower incisors, and as a consequence an alveolar abscess formed in each maxilla. The abscess has induced serious changes in the surrounding bone, and on the right side has led to necrosis of the singular trenchant premolar so characteristic of this curious group of marsupials.

Both incisors have undergone necrosis, and the

bone in the neighbourhood of the symphysis presents several cloacæ.

A study of these specimens, like others I have introduced to this Society, further supports the opinion that diseases of the teeth are not entirely brought about by civilisation. When the subject has been more fully investigated with the care it deserves, we shall find that animals suffer from dental affections to which man is happily a stranger, and although the possession of teeth is both a necessity and a privilege, nevertheless it has numerous disadvantages.

Discussion.

The President remarked that members ought to be greatly obliged to Mr. Sutton for his very interesting series of papers. He believed that most of them knew very little about the oral diseases of animals until Mr. Sutton called their attention to the subject. Busy practitioners had few opportunities of reading up collateral subjects of this kind, but some of their patients were very omnivorous readers, and were apt to ask puzzling questions respecting matters which they, as members of a learned profession, might be expected to have some knowledge of. It was, therefore, a great advantage to be instructed by such a comparative anatomist as Mr. Sutton.

Mr. Chas. Tomes said it was always dangerous to criticise Mr. Sutton's papers on the spur of the moment, since he was not in the habit of making suggestions without having carefully considered the point discussed, and it was therefore desirable to have some opportunity for thought before venturing to question his conclusions.

But he (Mr. Tomes) was scarcely prepared to follow Mr. Sutton in his proposal to abolish one of the recognised dental tissues. The term osteo-dentine, as applied to pathological products of the pulp, might perhaps be abandoned without inconvenience, but he thought it would be decidedly inconvenient to abandon it altogether, especially as applied to such organs as the teeth of the pike. In these the tooth pulp first forms a thin external layer by the calcification of a surface layer of cells—odontoblasts in fact; but the whole interior of the solid tooth—nine-tenths of it at least—is formed by a connective tissue calcification of the body of the pulp. Thus whilst he agreed with Mr. Sutton that osteo-dentine was always a connective tissue calcification, whereas true dentine

was a calcification of specialised surface cells, and that therefore it had much more in common with bone than with dentine, yet he thought there would be more loss than gain in nomenclature if its use was abandoned altogether—at all events for those teeth on which almost the whole of a specialized dentinal pulp became converted into it.

Mr. Sutton's suggestion as to the cause of the curling tooth of rodents and other animals was ingenious, and would account for the curling in many cases, but not in all. For instance, in the case of the widely curling tusks of the mastodon it was difficult to see where attrition could come in as a factor in causing the curvature, seeing that there were no opposing teeth.

Mr. F. J. Bennett thought the curling of teeth could not be satisfactorily accounted for by the merely mechanical cause suggested by Mr. Sutton. The rule was that friction stimulated nutrition, and was attended by increased growth in that part. The curling of leaves was found to be due to more rapid growth of that surface which received the larger supply of nutrition, and he thought the curling of tusks must be the result of unequal growth due to a similar cause.

Mr. Storer Bennett also criticised Mr. Sutton's explanation of the curving of teeth, pointing out that the lower incisors of rodents did not get worn on the upper surface, though they curved in that direction; and, secondly, that these teeth were curved before they left the jaw-bone or met with any attrition. Nor did he believe in the pathological ancestor of the babirussa.

He had noticed in the Zoological Gardens a tiger which had a remarkable growth in the mouth which always became larger just before feeding time; the tumour looked as if it might be an enlarged salivary gland. He believed the animal died about three months ago; was this the one Mr. Sutton had referred to?

Mr. Sutton, in reply, said he agreed with Mr. Tomes that it would be inconvenient to do away with the term osteo-

dentine unless a better one could be suggested, and this he was not at present prepared to do. Nor did the name very much matter so long as it was borne in mind that the tissue to which it was applied was a simple calcification of the connective tissue of the pulp, and differed entirely both in structure and origin from true dentine.

With reference to the objections which had been made to his suggestions as to the cause of the curling of certain teeth, he begged to be excused entering more fully into the subject at that meeting, since this would necessitate his anticipating an important part of a lecture which he had to deliver on that day week at the Royal College of Surgeons, in which he proposed to discuss this question at some length.

The tiger referred to in his paper was one which had been presented to the Prince of Wales during his Indian tour. It had a warty growth on the lip, which the keeper informed him used to swell up at feeding time, but after death it appeared quite collapsed and unimportant.

The PRESIDENT, having thanked Mr. Sutton in the name of the Society for his interesting paper, and also Mr. Underwood and the other contributors during the evening, proceeded to read the following Inaugural Address.

PRESIDENT'S ADDRESS.

Gentlemen,

Allow me to thank you for the honourable position in which, by your suffrages, I find myself placed this evening; but while I do this, a sense of inadequacy rises within me when I remember the long list of well-known and highly appreciated predecessors who in the past have occupied this chair. While sensible of my inability to place myself on a level with those who may justly be regarded as the fathers of the profession in England, I claim to stand second to none in love for that special branch of surgery which we practise, and they did so much to advance. In looking back down the long vista of my professional experience it is gratifying to note the advances made by those who, going before, bore the burden and heat of the day; working in comparative isolation, and doing such good work that their names became familiar as household words in the mouths of all who were best qualified to appreciate and judge of it. Their appliances were comparatively crude, and their remedial agents few—it was not for them the barbed nerve extractor, the electro-magnet, and the burring engine with its multifarious bits—yet they triumphantly overcame difficulties which occasionally baffle us now.

It needs not the panegyric of an address like this to sing the praises of those who founded this Society; these live sufficiently in our surroundings.

I well remember the period when their honoured names could well-nigh be counted on the fingers of a man's hand. Their power as individual members of the profession was limited; few opportunities existed for their meeting in a corporate capacity, and discussing matters of professional

interest. When once the tide of co-operation set in, that little cloud not bigger than a man's hand foreshadowed a mighty torrent of advancement, whose waves of improvement have not only resulted in the refinement of our surgical appliances, in the advance of our dental therapeutics, and the extension of our means of combating dental disease, but in fostering friendships far and wide, and in a Society like this adding daily to our mutual knowledge. The practitioners of the past, in forming this bond of union between us, laid the foundation for the furtherance of our knowledge—*they* laboured, and *we* have entered into their rest. I should qualify that word rest, as I refuse to accept finality in the path of progress. They have been, as it were, translated from the scenes of their early labours, and their mantle has fallen upon us; we are the trustees of that legacy they have left for those who follow, and it remains for us as a Society to fulfil that trust by carrying on the advance they started.

It needs but a transient glance over the records of the Odontological Society to see how that trust has been carried out in the past. The valuable papers brought before us from time to time testify to the watchful interest its members take in all which relates to the practice of their profession, and their anxiety to extend this knowledge to the benefit of their suffering patients. But while there is much cause for congratulation, it is to be regretted that so many abstain through diffidence from coming forward to assist in a more constant supply of communications bearing on topics of general and daily practice. There are many subjects which need further light, and which have by no means received their ultimate illumination. Our newly acquired remedies need further use and observation, and their merits to be, by a species of collective investigation, well threshed out. Many of these remedies come before us with respectable credentials, but they require to be proved. Take our

experience of the recently introduced Cocaine and its application to Dental Hygiene. Judged by the notice we as a Society have given it, and by personal experience, it falls far short of what we had been led to expect from its character as a local anæsthetic serviceable in dental surgery. It is only by our concentrated observation and frequent trials that we can glean from it all that is good, and reject that which is useless to us as a remedial agent.

In my own practice I have only found it truly of service in calming the intense pain which follows the extraction of a highly inflamed tooth; but others may have experiences of a different character to bring forward, and casual communications embodying such experiences would be very acceptable, and would greatly conduce to our mutual advance.

Again, we have had in late years great additions to the antiseptic remedies employed in dental surgery. These remedies, as is well known to us all, are of great importance in the treatment of exposed pulp. Time was when creasote was about the only antiseptic agent in use for this purpose, but later researches have added to our "*armamentaria*" carbolic acid and its various relations, which I believe is an antiseptic agent not to be superseded. It possesses a capability of penetration into inaccessible sinuses beyond many other much vaunted remedies, and although many surgeons have a fear while they use it in severe operations lest carbolic poisoning should supervene, we use it in such small doses that no dread of mischance attends its employment. Moreover, its peculiar action upon an exposed pulp is favourable in many ways; the first application condenses the albuminous element of the surface and closes it against the entrance of putrescible germs; furthermore, it acts as a local anæsthetic on the nerves of the pulp during its destruction by escharotics. These qualifications, in addition to its antiseptic character, constitute it a most valuable addition to our dental therapeutics.

Now while we may be thoroughly satisfied with the results obtained through the instrumentality of this agent, the question still exists, can we find a better? Another antiseptic agent the use of which has lately been advocated by Mr. John Wood deserves careful trial at our hands. Being so recently introduced I have not been able to test its capabilities to the utmost, but coming as the recommendation does from one who bears such a well-deserved reputation for surgical skill and analytical observation, it will doubtless prove of as great utility in our hands as it has in his, while it will be free from many of the objections attached to carbolic acid. Peroxide of hydrogen, according to Mr. John Wood, is one of the most powerful microbicides known. He says in his recent Bradshaw lecture on Antiseptics in Surgery: "So small a proportion as one part in 2,000 is efficacious in preventing the beginnings of putrefactive fermentation, and destroying the activity and propagation of bacteria and micrococci of all kinds. It is absolutely innocuous, and is quite free from any suspicion of local or constitutional irritation." Such a recommendation, coming from so good an authority, carries with it a strong desire to test its efficacy in the prevention of suppurative action in our treatment of exposed pulp and the cure of alveolar abscess. It is to be hoped this efficacy in dental surgery may be put to the test, and the results made known to us at some future time in a short paper. Antiseptics perform such an important *rôle* in the conservative surgery of the present day that every fresh one recommended to our notice should undergo the severest trial of its merits before being admitted to our fullest confidence, as many such, after having been weighed in the balance of our experience, have been found sadly wanting. I feel strongly disposed to say that this peroxide of hydrogen will justify our expectations, and not be relegated to that limbo to which so many other much praised antiseptics have been consigned at last.

I would again suggest another subject to which our united and concentrated attention might be directed with a view to the elucidation of its cause and treatment. I mean that obscure disease, erosion of the teeth, or, as Hunter called it, "decay by denudation." We meet with it in practice almost as frequently as we do caries, but while we can by stopping a tooth arrest caries and save that tooth, erosion on the other hand goes on with a determination we can do little to check. Many theories have been advanced in explanation of its cause, but none upon which to found a firm basis for treatment. My own conviction on the subject, coupled with the evidence of patients themselves, leads me to infer that a gouty or rheumatic diathesis lies at the foundation of this disease—that the acid engendered in the system, exuding from the gums, attacks those parts of the teeth immediately contiguous, and in combination with the friction of tongue, lips, and food, removes an infinitesimal portion every day. This opinion is strengthened by the small quantity of tartar coating the teeth in the neighbourhood of the erosions, and by the reddening of blue litmus paper placed in contact with the gums of the eroded teeth; but this is only a suggestion on my part as to the cause. I think it is a subject worthy of united consideration, for in erosion we have a disease which up to the present time seems to defy all our powers of observation and treatment, and might therefore fitly furnish a subject for collective investigation by which we might obtain data for the elucidation of its cause, and upon which we might ground its successful treatment.

I am not aware of anything approaching original investigation having been of recent years devoted to this disease, nor anything so full and complete as the *résumé* of it given by our old and valued though absent friend, Mr. Alfred Coleman, before the International Medical Congress in 1881, and to which I would direct your attention.

There are also many other obscure points in dental pathology to which attention might be directed with advantage to us all, and one is the cause of that premature decay of the first permanent molars, common amongst children during the past forty years or so, and for which parents generally and anxiously require an explanation.

From occasional microscopical examination of such of these teeth as I have removed in an early stage of decay, I am inclined to attribute one cause of it to an apparent want of fusion between the advancing centres of calcification of the enamel, an arrest of development leaving pipe-like fissures in the masticating surfaces, which become foci of chemical action from the fermentation of food squeezed into them. But in addition to this malformation there is an appearance of general weakness in such teeth, which can only be accounted for on the hypothesis of some disturbing influence during an early period in the life of the child interfering with the normal development of this particular tooth, sometimes in conjunction with that of the incisor teeth; but as this peculiar disturbing influence affects the majority of the children who come under our notice, it becomes very desirable that we should investigate its history, and if possible trace the evil to its source.

But I need not occupy the time of this meeting by multiplying these suggestions towards further investigations. I can only state that as former occupants of this chair have always stretched out a warm hand of welcome to any of the members of this Society who have come forward to give us the benefit of their experience, this year shall not form an exception. We have from time to time received valuable information from many outside the boundaries of our speciality, and while we have been deeply absorbed in listening to their interesting and instructive papers, we have been precluded from taking any active part in the discussion of them by reason of their subjects not coming within the

scope of our daily experience. Such communications will always receive that attention their high merits deserve, and their authors will always be thankfully appreciated, but we feel that more papers should come from within our ranks. We number amongst us men of high educational attainments, and we are justified in expecting from them, if they strictly fulfil their mission as members of a Society, a fair contribution now and again as the result of their thoughtful investigations, and bearing as these would probably do on the work of our daily lives, they would be discussed, not to our benefit alone, but for that also of those who seek our professional aid. I leave the consideration of these suggestions to the willing hands and hearts of our younger brethren in this Society—to those who have the energy and vigour and probably the leisure of youth. The greatest advances in a state may be confidently looked for in that *via media* between the vigorous impulse of youth and the mature restraint of age, and our younger brethren may confidently rely upon being listened to by their elders here with that attentive interest which has always been evinced in the subjects so brought before them, and in the subsequent discussion the mature judgment of older practitioners will correct where necessary, but not with unkindness. It does not speak well for any Society where the burden of finding a supply of communications is thrown upon the executive, and where the members are content to play the *rôle* of lay figures to make up an audience, and I sincerely hope that that diffidence which is so closely associated with this state of affairs may be dissipated as dew before the rising day, and that those who now retire behind this cloud may emerge to aid us in our desire to still further advance the scientific boundaries of our professional practice. Before resuming my seat, let me again thank you for the honour you have done me in electing me to the dignity of being your President for the coming year.

Vote of Thanks.

Mr. Thos. Underwood proposed a vote of thanks to the President for his very suggestive address. As originally founded, the Society was intended to serve both political and scientific purposes. Its political work had been to a great extent accomplished, but as regards the scientific aspect the work before it was, as the President had pointed out, as interesting and as valuable as ever. Such being now the main object of the Society, it was a pleasure to see it presided over by one eminent in the scientific world, especially in connection with microscopical science, and he looked forward to a prosperous year under Mr. White's guidance.

Mr. Robert Hepburn seconded the motion, which was carried with much applause.

The President expressed his thanks, adding that he had found it rather a difficult matter to write an address. So many of the subjects he would have liked to have touched upon had been treated of by his predecessors that the ground seemed at first to have been completely cut away.

He then announced that at the meeting on March 1st Dr. Dudley Buxton would read a paper on the "Physiological Action of Nitrous Oxide." The April meeting would be devoted entirely to Casual Communications, which were frequently quite as interesting and instructive as a formal paper. Amongst these would be one by Dr. Walker on "Continuous Gum Work," with reference to the remarks on that subject made by Dr. Cunningham at the last meeting.

The Society then adjourned.

H. R. Barraud, Photo. *Woodburytype.*

ROBERT HEPBURN, L.D.S., Eng.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

March 1*st*, 1886.

T. CHARTERS WHITE, M.R.C.S. & L.D.S.Eng.,

President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

Mr. Morgan Hughes signed the Obligation Book, and was formally admitted to membership by the President.

The President announced that the following gentlemen had been duly nominated as candidates for membership, and would be balloted for at a subsequent meeting, viz.:—

Messrs. Alfred Edward Clayton Woodhouse, M.R.C.S., L.D.S.Eng., 1, Hanover Square, W.;
Murray Davis, L.D.S.Eng., Wimpole Street, Cavendish Square, W.;
George G. Campion, L.D.S.Eng., 264, Oxford Road, Manchester; and
Horace J. Lloyd Farebrother, L.D.S.Eng., Salisbury.

The following candidates were then balloted for and elected members of the Society, viz.:—

Messrs. W. J. England, L.D.S.Eng., 40, Wimpole Street, Cavendish Square, W.; and
Thos. Fred Barton Palmer, M.R.C.S., L.D.S.Eng., Priestgate, Peterborough.

Mr. Weiss announced that the President had presented to the Library a copy of Foster's "Handbook for the Physio-

logical Laboratory," illustrated with photographs of microscopical specimens taken by himself.

The Curator (Mr. Storer Bennett) reported that he had received from Mr. Brunton, of Leeds, two photographs of Mr. Dunn's sections of the fractured and reunited tooth exhibited earlier in the session. Mr. Trench, of Queen Street, Northampton, had sent for the Museum a specimen of geminated upper molars. Mr. Penfold had presented an aquatint picture, dated 1796, representing the extraction of a tooth in a somewhat primitive manner, evidently affording much amusement to the on-lookers, and Mr. Wilson, of Hull, a plate which had been supplied to one of his patients while resident in Japan. The patient went seven days' journey to the town at which the dentist was practising, and had to remain there a fortnight, and after all this trouble and expense the plate was found to be quite useless. The practitioner in question was *not* a native of Japan.

He had also acquired for the Museum the skulls and lower jaws of a female dugong, of a young hippopotamus, and of an American wart-hog. These specimens he hoped to describe more fully on a future occasion.

The Secretary showed a model sent by Mr. J. C. Foran, of Eastbourne, of the mouth of a girl, aged thirteen, showing the effects of necrosis caused by typhoid fever, and read notes of the case.

The girl, when eight years old, had a very severe attack of typhoid fever. During the illness it was noticed that the four lower incisors were quite loose, and in a short time they came away together with sequestra of necrosed bone. Not long afterwards the canines erupted and moved forwards, filling the gap in the way shown in the model.

The upper teeth were quite normal, except that the mouth was rather crowded, notwithstanding the fact that the upper first bicuspids had been extracted to make room.

The President remarked on the remarkable manner in which the gap caused by the loss of the incisors had been

filled up. It seemed probable that when the wisdom teeth were erupted the small space left would be closed up.

Mr. Whatford, of Eastbourne, showed a model of the upper jaw of a young man, aged eighteen, showing absence of the bicuspid teeth on either side. The temporary canines had been retained and the permanent canines had come down between them and the six-year-old molars. The patient's father and younger brother had the same deficiency, both retaining also the temporary canines. No very reliable history could be obtained with regard to the temporary molars, but it seemed probable that they were not erupted.

The President remarked that he had met with a very similar condition in a young lady who consulted him on account of the deformity. Both the temporary and permanent canines were present, the latter, as in this case, having been erupted at a considerable distance from the laterals. The young lady's father, who accompanied her, presented the same peculiarity.

Mr. Storer Bennett said he had received some specimens to exhibit to the Society from Dr. Herbst, of Bremen. Amongst them was a new ring matrix, similar to one which he (Mr. Bennett) had been using for about three months, and had found very efficacious, it was simple and easily made. There were also two medallions made from signet rings by the rotation method in five minutes each, showing clearly the very close adaptation of the gold to the surface against which it was packed which was obtained by this method; a molar entirely built up from the root in an hour and a quarter—very quick work, considering its size; and specimens of some new (No. 30) gold foil made by Wolrab.

The President said most of the specimens appeared to be similar to those sent to the Society last year by Dr. Herbst, but they were good illustrations of the capabilities of the process. The medallions especially showed well what perfect contact could be obtained between the gold and the walls of the cavity. He thought the method had a splendid future

before it, and that the present generation of students enjoyed a great advantage in being trained in the practice of so valuable an addition to the ordinary modes of filling.

Dr. Field exhibited a new dental engine sent by Messrs. Jamieson, of Broad Street, in which the driving band or cord was dispensed with. On working the treadle the central upright rod of the engine revolved; at the upper extremity of this was a small horizontal wheel which acted on another vertical wheel which was attached to the lower end of the flexible arm. The machine was thus very simple in construction, there was no cord to get twisted or loose, and the action was quite noiseless.

He also showed two scalers for removing tartar from the lower molars, mentioned by Dr. Harlan at the previous meeting.

The President said he understood that Dr. Field himself was entitled to the credit of having suggested the very ingenious modification of the dental engine which had been carried out by Messrs. Jamieson.

He thought Dr. Harlan's scalers would be very useful, not only for the teeth for which they were specially intended, but also for passing between the lower incisors. He then called on Mr. Dudley Buxton to read his paper on "The Physiological Action of Nitrous Oxide."

On the Physiological Action of Nitrous Oxide.

"Quant à l'action anesthésique en elle-même, elle est parfaitement independente de l'asphyxie, et elle se produit par un tout autre mécanisme."—Claude Bernard.

By Dudley Wilmot Buxton, M.D., B.S.Lond., M.R.C.P.

Administrator of Anæsthetics in University College Hospital, the Hospital for Women, Soho Square, and the Dental Hospital of London, &c.

Mr. President and Gentlemen,

In reintroducing to the notice of this Society the subject of nitrous oxide gas, I feel some preface is called for, some explanation demanded.

To most members of this Society it will not be difficult to recall the various occasions upon which the subject of nitrous oxide has been brought upon the carpet, and, for the time being, fairly threshed out. The Proceedings of the Odontological Society give evidence of two facts in relation to the subject of my paper: they reveal that the Society at large took a keen interest, an interest which I venture to think has in nowise flagged or grown less real as time has gone on; and then that the members of this Society are, as a rule, experts who speak from the standpoint of experience, and not from hearsay. I shall, with your permission, later on, have to cite the experience and experiments of members of this Society, and

shall amply substantiate the truth of my statement that the Odontological Society speaks as a body of experts.

I shall not detain you, gentlemen, with expressions of my own unfitness to address you upon a subject with which you are already familiar, because my fitness or unfitness will amply be shown before we part this evening. I will say that I, as a student of the great physiological puzzle, our body, am simply and earnestly seeking for truth. I come here to lay what facts I possess before you, and only desire to go away again with a fresh store of information gathered from my fellow workers in this field.

The subject before us, which is the physiological action of nitrous oxide gas, is one of wider compass than at first reveals itself. The literature devoted to it is abundant, but the results arrived at are not commensurate with the amount of ink spent and paper spoilt. This is not wonderful, since the question is one of extreme difficulty, experimental research undertaken in its elucidation is both arduous and laborious, and so many writers have adopted the easier plan of working up old material which they have garnished with crude criticism. The whole subject is at the present time really confused by conflicting theories and experimental results, which, while presenting a mass of information, are almost irreconcilable. This unsatisfactory

state of affairs has prompted me to undertake an attempt to clear up some points, and harmonise some discordant conclusions. The task before me is of course of vast magnitude, and certainly more onerous than I could hope to bring to a satisfactory termination were my temerity such as to make me contemplate the undertaking single-handed. As it is I contemplate a prolonged research, and was therefore most grateful when your courteous Secretary permitted me to lay the matter before you, so enabling me to enlist your sympathies in my work, and to submit to you certain conclusions and facts upon which I might seek the ripened criticism of your prolonged experience and careful personal observation. I confess that I, like Frankenstein, have not a few times shrunk in dread from the monster my hands and brain had fashioned. By a happy thought, however, and a second appeal to Mr. Woodhouse, I was able to quiet my fears. By cutting my monster in pieces he appeared less huge and cumbersome and altogether less formidable. In short I suggested, and my view was kindly fallen in with, that I might first be allowed to bring in review the facts which bear upon the physiological action of nitrous oxide gas, and to indicate how far the conclusions hold from the premises adduced, and how far they correspond with our present experience; while I should reserve for the present the more strictly experimental part

of my research until we had cleared the ground from mere *à priori* reasoning, and had sifted the evidence as at present placed in our hands.

Many of the facts which I propose to bring before you to-night will be familiar to you as facts, although I venture to think their true significance in many cases has been overlooked. This has occurred because there has not been an attempt made to bring them into sequence, and to trace the subtle cord of correlation which subsists between them. It is my aim to attempt so to marshal our facts that we may clearly ascertain their true bearing, and thus be enabled to see what gaps still exist in the chain of evidence.

Nitrous oxide—

(*a*) is said to produce a state which we term *anæsthesia*—a loss of sensation ;

(*b*) it initiates certain emotional states, provoking a sensation of exhilaration and well-being—in fact, it plays the *rôle* of a stimulant ;

(*c*) it gives rise to modifications of the respiratory and

(*d*) circulatory systems ;

(*e*) and provokes marked muscular movements, which may be roughly classed as

(i) rigidity or contracture, and

(ii) jactitations.

These are, speaking broadly, the effects of ni-

trous oxide upon the mammalian organism, and in attempting to explain them we must ascertain their relations among themselves. In the first place it is essential that we should assure ourselves whether the conditions of our problem are simple or complex. I propose to show that the latter is the case, and that many of the phenomena attributed to nitrous oxide are, in point of fact, merely accidents of our methods of introducing the gas into the lungs.

The main point of interest in the physiological action of nitrous oxide is the production of anæsthesia. Now this condition, the loss of power of perception of sensation, together with the state of analgesia, or loss of sensation of painful impressions, may arise from want of action of the sensory end-organs, of the conducting sensory nervous fibres, or of the receiving and perceptive centres. These distinctions the pathologist points to as resulting from various neuropathic lesions. We are all aware that local anæsthesia, as it is called, and local analgesia are determinable by such applications as aconitine, cocaine, cannabis indica, and we are aware that in certain rare cases etherisation will call into being a true analgesia, a condition in which a patient is spelled into a sensationless trance, while he possesses his faculties sufficiently to know what is going on.

That nitrous oxide is neither a true anæsthetic

nor a true analgesic is the first proposition I propose to consider. I submit that the evidence goes to show that sensation is retained until the perceptive powers themselves cease to receive. That sensations, whether merely tactile or painful, are not blocked at the end-organ, nor is their progress interfered with along the nerves which connect the sensory end-organs with the spinal cord and brain, and hence the stoppage is carried back to the centres themselves. A further fact is that I have observed, and I believe I am in harmony with most of the authorities upon the subject, that during the stage immediately anterior to the loss of consciousness, persons under the influence of nitrous oxide are *hyperæsthetic.* Now observe the significance of this fact. Under normal conditions, we move our limbs in response to stimuli, and do so in an orderly fashion; we experience sensations of heat or cold, of touch, light, and so on, without distress, and this is because the complex mechanism of our reflexes—the end-organ and conducting fibres to the nerve centres, the nerve centres themselves, and the efferent fibres thence to the muscles—are all acting harmoniously, and are under the control of the inhibitory centres in the cerebro-spinal axis. When from any cause these inhibitory centres are thrown out of gear we have on the one hand excessive muscular movements, on the other

excessive sensory impressions. A whisper becomes magnified to a roar, the fall of a pin assumes the importance of the crack of a whip, and so on. This, then, I venture to submit, shows that, if I am right in stating that nitrous oxide does induce hyperæthesia, the cerebro-spinal axis, at least as far as sensation goes, is the seat of the changes which nitrous oxide induces, and which culminate in the complete abeyance of consciousness. In investigating this fact I would, however, urge your attention to an important caution. The personal equation of sensibility varies within wide limits. So coarse are the senses in many persons—the lympho-phlegmatic—that hyperæsthesia in them scarcely amounts to more than the normal sensibility in the nervous temperament, and so we cannot with propriety reason from their cases. In this connection I would draw your notice to the convenience of grouping the brain phenomena due to nitrous oxide in three periods: the period before unconsciousness, which I contend is the hyperæsthetic period, the period of unconsciousness, and the period of returning consciousness, in which I believe nitrous oxide hallucinations take their origin.

Now if nitrous oxide does indeed effect molecular changes in the brain, a point to which we shall return later, we have yet to examine the means by which this gas enters the system and is enabled

to produce its central effects. We are here met by a most comprehensive problem. One of the following conditions presumably constitutes the mechanism for which we are seeking:—

(*a*) The nitrous oxide may either give rise to other bodies by changes in its own chemical form; or

(*b*) Acting purely in a mechanical fashion it may upset the normal equilibrium of the function of respiration, and so give rise to accumulation of aërial fluids in the blood, and which would normally be excreted.

(*c*) It may act *per se* and exercise a specific action just as strychnine or any other body.

We will dispose of these propositions in the order in which they stand. At one period it was believed that nitrous oxide acted as an oxidising agent, by splitting up in the body or tissues into oxygen and a residuum of nitrogen compounds, and hence came into vogue the Apnœal or Hyperoxygenation theory of Colton. In support of this theory, Stillé and Maisch urge that venous blood is arterialised by shaking it with nitrous oxide, that phosphorus burns in it, that seeds germinate under bell-jars of nitrous oxide. Zimmermann, whose paper I have not been able to consult, is pledged by Stillé and Maisch to the statement that

pigeons and rabbits will recover after being placed in the gas for eight hours. Of course, were such contentions true, we should have to admit that nitrous oxide is a respirable gas. However, it is difficult to believe any of the assertions when viewed by the light of modern research. For it is well within the memory of this Society that the Committee appointed by it tendered, I believe in the year 1873, their second report, in which is given the results arrived at by Dr. Frankland. This observer came to the conclusion that nitrous oxide was not decomposed during its sojourn in the body, basing his opinion upon analyses made of air expired by rabbits when confined in an atmosphere of mixed air and nitrous oxide. With these analyses I will not detain you. Others, adopting less exact methods, have arrived at the same result, and Coleman pointed out that were oxygen liberated, it would probably produce the most baneful results upon the organism. However, this objection has little weight when we consider that it would be the tissues of the body which would take up the oxygen liberated from the gas and employ it for molecular integration. Jolyet and Blanche, who publish their results in Brown-Séquard's "Archives de Physiologie," find vegetables as well as animals die incontinently when placed in an atmosphere of nitrous oxide. And I have in the case of certain seeds failed to induce germi-

nation in an atmosphere of pure nitrous oxide. Of course combustion will take place in nitrous oxide, provided the heat be sufficient to produce "the mode of motion" in the molecules of the gas which leads to their disintegration; but experiment has shown that the heat of the blood is insufficient to initiate such a dissociation.

But perhaps the most crucial argument adducible in confutation of the hyperoxygenation theory is that apnœal states are by no means necessarily anæsthetic conditions. Bonwill's suggestion of rapid breathing to produce anæsthesia probably acts rather through the changes it produces in the blood pressure of the cerebral circulation or nervous exhaustion, than by dint of hyperoxygenation. But all these observers have apparently overlooked another way in which the nitrous oxide may be introduced into the system, and exist as a quasi-compound in the blood and respiring tissues. We are well aware that carbonic monoxide, hydrocyanic acid, and the nitrites, bodies of especial interest to us at present, are capable of entering into a combination with the colouring matter of the blood, oxyhæmoglobin, and that of the respiring tissues, oxy-myo-hæmatin, and forming more or less stable bodies which are isomorphous and present kindred physical properties. We cannot fail to recognise at least strong chemical bonds of union between nitrous

oxide and the nitrites, nor does it appear to me to be a far-fetched hypothesis to suppose that nitrous oxide enters the blood in some such a combination. At the same time I have no actual proofs of what I have suggested, since there is extreme difficulty in eliminating mere asphyxial from nitrous oxide spectrum if such a one exists. Of course when an animal is killed by nitrous oxide, the blood, if examined within two minutes of death, gives the well-known spectrum of reduced hæmoglobin, while the muscles give the corresponding one of reduced myo-hæmatin. Here we are dealing, not with nitrous oxide blood effects, but these complicated and probably overridden by asphyxial effects. Later on we shall have to point out a further possible way by which nitrous oxide may be introduced into the organism.

Let us now consider whether nitrous oxide can act simply mechanically by ousting the oxygen from the oxyhæmoglobin and oxy-myo-hæmatin, *in fine* as an indifferent irrespirable gas.

It is conceivable nitrous oxide may act as a simple irrespirable gas in precisely the same way as nitrogen, hydrogen, and so on, or it may deoxidise the blood acting as a reducing agent, such as ammonium sulphide ; in either case the end arrived at is the same, viz., asphyxia. It was to this conclusion that Jolyet and Blanche arrived when they wrote, " Le protoxyde d'azote étant un gaz irrespirable et ne

possédant les propriétés anesthesiques qu'on lui a attribuées, son emploi ne peut être que dangereux, et doit à ce titre être proscrit de la pratique médicale."

It has been said by those who regard nitrous oxide as analogous in its action to nitrogen, or any other indifferent gas, that it differs only in so far that one gas is able to oust oxygen from oxyhæmo-globin sooner than another, an assumption which seems to me to be purely gratuitous, since the reduction must take place in the tissues, the blood supplying them until its store of oxygen is exhausted, when asphyxia takes place. Bernard, whose classical work on asphyxia gives the fullest account of that condition with which I am acquainted, speaks of three forms of asphyxia :

(1) That arising from inhalation of irrespirable gases which are themselves harmless. To this class many authorities would relegate nitrous oxide.

(2) That due to poisonous vapours, such as carbonic monoxide, sulphuretted hydrogen; and

(3) Asphyxia from want of air, such, for example, as would ensue upon ligature of the trachea. He subsequently points out, and I think with justice, that asphyxia resulting from the inhalation of an indifferent irrespirable gas, and that due

to want of access to air, are in fact one and the same condition.

Let us now consider very carefully indeed the process of phenomena ensuing upon deprivation of oxygen, that we may compare them with the course of events in nitrous oxide narcosis. It seems to me that, even if we fail to establish what is the exact nature of nitrous oxide narcosis, we cannot fail to see many striking discrepancies between it and asphyxia pure and simple.

The arterial blood becoming gradually deoxidised, by parting with its oxygen to the tissues, acts upon the Medulla respiratory centres; hence follows hyperpnœa. This in the case of some persons subjected to experiments by Drs. Burdon Sanderson, John Murray, and Mr. J. Smith-Turner, who caused them to respire pure nitrogen, did not occur for about two minutes after commencement of inhalation. With the increased venosity of the blood follows the tumultuous breathing of dyspnœa when all the accessory muscles are called into action. Subsequently expiration becomes markedly in excess of inspiration. Expiratory convulsions then ensue. The convulsions cease owing to the exhaustion of the nervous centres, the pupils are dilated, the conjunctival reflex cannot be elicited, the muscles are flaccid and quiet. At ever lengthening intervals the respiratory centre gathers itself together, and starts a long

inspiration; these grow more and more shallow, and at length cease. Lastly the heart stops. It is convenient to separate these phenomena into three stages:

(1) Dyspnœa, when both inspiration and expiration are in excess;

(2) Convulsions, when expiratory efforts exceed inspiratory;

(3) Exhaustion.

Now let us contemplate the circulatory changes occurring during the procession of these phenomena. The first change of importance is a rapid rise of blood pressure; this, persisting during the first and second stages, is due to stimulation of the vaso-motor centres by the venous blood, resulting in a constriction of the arterioles. Coincident with this is an acceleration of the heart beat; this, however, rapidly gives place to slowing and increase in the force of the beat. During the third stage the blood pressure rapidly falls to nil, and the heart beats become very slow and feeble, and finally cease. The duration of these stages of asphyxia have not been accurately determined in the case of human beings. In dogs the first stage occupies about a minute, and death ensues in four or five minutes. In the cases cited above, when patients were partly asphyxiated with nitrogen, they were subjected to the process for periods varying from three minutes to four minutes, and

yet had evinced none of the phenomena usually found in the second stage of asphyxia. We also know that voluntary breath-holding can be maintained for over a minute; hence it would seem not improbable that man takes at least as long as dogs to die from deprivation of oxygen.

Now I would ask your close attention to the phenomena of the so-called asphyxia of nitrous oxide narcosis.

In the first place we find a tolerably uniform increase in the number and depth of respirations. I have never as yet succeeded in detecting any excess of expiratory over inspiratory movements. The respirations are, and I speak under correction, simply an exaggeration of the normal, quite regular, but hurried in rhythm and increased in depth. And this begins certainly within half a minute, usually within fifteen seconds, from the commencement of nitrous oxide inhalation. The respirations, however, slow as narcosis proceeds, and finally stertor supervenes, which frequently is followed by a period of complete respiratory calm, no thoracic movements appearing. A few seconds more and respirations are recommenced, and the person passes quietly into the ordinary swing of his breathing. I have never observed anything which in the slightest degree resembled the expiratory convulsions one is so familiar with in the case of the lower animals killed by asphyxia.

Again, in considering this subject it occurred to me that one should find the same circulatory changes taking place during nitrous oxide narcosis as obtain during asphyxia were the conditions one and the same. I am at present engaged upon this research, but have not been able to place the matter beyond doubt. In a series of sphygmographic traces, some of which I have placed before the Society, I have sought to determine what variation in tension occurs during nitrous oxide narcosis. These traces were taken upon persons sufficiently accustomed to inhaling the gas to eliminate as far as possible the circulatory changes due to fear, &c. I need hardly add no surgical procedure was undertaken, as such must have introduced the disturbing element of shock. I mention this as in some of the traces published such surgical procedure has been allowed, and so, as I think, a most disturbing factor introduced. In conducting these experiments it has been my custom to take a tracing of the normal pulse before narcosis was commenced; and then after ten seconds or so of gas another trace was taken, and this was continued until consciousness returned.

In no case have I succeeded in obtaining any marked increase in tension in the pulse trace, and there has appeared to me to be an actual lessening of the tension during narcosis, as evidenced in the loss of tidal wave. I should mention that

in most cases the narcosis was pushed very far, jactitations and extreme cyanosis being induced. A careful study of the tracings now before the Society* will reveal the following facts. In the first place there is a very notable acceleration of the pulse, and this persists throughout the whole period of narcosis; secondly, the following signs of a lowered tension will be recognised. The tidal wave is lessened or almost lost, the dicrotism of the pulse becomes strongly marked; the acuteness also of the initial curve will be seen to be considerably increased. A further point will be observed in some of the traces, viz., that the dicrotic wave is further down the curve when the patient is under the influence of the gas than is normal. These evidences of lowered tension appear to me to be constant in my results, although of course I can only show a few specimens here to-night. Now, unless we deny the evidence before us, it seems at least remarkable that nitrous oxide should cause such evidence of lowered tension, unless it was really a fact that in some way nitrous oxide is capable of lowering the tension of the blood in the arteries, and of accelerating the heart's action. At the same time I am anxious not to seem to attach an undue importance to sphygmographic records; I would simply urge that taken with the utmost caution they reveal a fairly uniform result. To

* See pp. 155–158.

investigate this question of blood pressure still further I have undertaken some experiments whereby the actual pressure in the blood vessels of dogs has been determined. The results of these I hope to lay before you upon a subsequent occasion, but I may say that when due allowances are made I believe the results will go to strengthen my present contention, that nitrous oxide pushed to the extent of narcosis does not give rise to circulatory changes at all comparable to those occurring in the course of asphyxia.

The results obtained by the cardiograph in the human subject have not been encouraging, and I have therefore determined to investigate the exposed hearts of mammals as likely to render a more reliable record. In this connection the experiments of Amory, Krishaber, Goldstein, and Kuntz are of interest. These observers found that animals, when subjected to the vapour of nitrous oxide, after a time died. Now it is important to notice that the animals, when made the subject of a post-mortem examination, revealed the usual signs of asphyxial poisoning. But this is of course a wholly different thing to death from nitrous oxide. In these animals nitrous oxide narcosis was followed by suffocation, air was excluded, and hence asphyxia ensued. I believe it has happened to skilled anæsthetists to have a necessity of maintaining nitrous oxide narcosis for

a considerable time. This has been done by allowing the patient to respire air at long intervals. In this way a really prolonged narcosis can be effected. Clearly in such cases the narcosis was something wholly outside of the concurrent asphyxia, and it is the great disadvantage of our present methods of administering nitrous oxide that we can hardly avoid producing more or less asphyxia while we are seeking only to promote the action of nitrous oxide upon the nervous centres. M. Paul Bert has by his well-known plan sought to obviate this drawback. I do not propose to address you upon his method, as that is as well known to you as to me, but I claim your attention to the important fact which underlies the success of M. Paul Bert's system. It is, that so long as he succeeds in supplying the bodily need of oxygen side by side with enough nitrous oxide to induce narcosis, he is able to achieve a prolonged unconsciousness, and yet his patient maintains his respiratory and vital equilibrium. I have no personal experience of the method, nor am I aware whether a narcosis lasting so long as an hour has been achieved.

It yet remains to be shown whether nitrous oxide acts in virtue of a power it might possess of reducing the oxyhæmoglobin of the blood, the oxy-myo-hæmatin and oxyhæmoglobin of the tissues. Were this the case we should expect to find it capable of either fixing the oxygen, as

in the case of carbonic monoxide hæmoglobin, or of producing a very rapid asphyxia, which I have attempted to show it does not do. I am also unaware of any facts which show that nitrous oxide is capable when in the blood of linking itself, on the one hand, with another molecule of oxygen, or on the other of fixing the oxygen in any other tissues, including the blood; if neither of such occurrences actually happen, it is hard to see what becomes of the oxygen, even were nitrous oxide capable of ousting it. As I have pointed out above, the evidence we derive from spectroscopic examination is not convincing, as MacMunn only examined the blood after death, and not simply during narcosis. A test of great value would be the examination of blood shed during an operation performed when narcosis after Paul Bert's method had been obtained.

We may, I think, then, conclude that nitrous oxide produces narcosis by virtue of other than asphyxiating qualities.

This gas, then, enters the blood through the lungs and exercises a certain specific action upon the nervous centres. And here we have a ready explanation of an otherwise most anomalous circumstance, viz., that in a certain number of cases persons evince the utmost toleration for nitrous oxide, and resist its nepenthal action for a minute or more. I doubt not members who are here

to-night can furnish me with instances of this idiosyncracy. In other words, these persons need a larger *dose* of this agent, nitrous oxide. It is inconceivable, I think, that were the effect other than a specific one, that quantity, or dose, as I prefer to call it, could have any effect. To explain. Were I to curarise a rabbit, I should produce complete paralysis of all its muscles, and the creature would die asphyxiated. Now I should always produce this result whatever quantity above a certain dose was given; the asphyxia is mechanical. So, were nitrous oxide purely an asphyxiant, I should invariably narcotise my patient when I had replaced his oxygen; but such is not the case—in fact, I narcotise him *before this oxygen is exhausted*, and I submit a long while before.

But there yet remains to discuss in what consists this specific action of nitrous oxide. As I explained, it is impossible for me in the space at my disposal to enter at all fully upon this question upon the present occasion, and so I will confine myself to a brief summary and leave it for elaboration in my next paper.

Nitrous oxide, then, may be taken as in all probability entering the blood by forming a loose combination with either the oxyhæmoglobin or the globulins and other albuminous bodies. It then passes to the nerve centres, and gives rise to subjective exhilaration, acting in fact as a

stimulant. Upon the heart it would in this stage appear to act mainly as an accelerator, but in what way I am at present not prepared to hazard a speculation. Subsequently the nervous centres pass from their initial stimulation to a condition of narcosis in which volitional activity is in abeyance. At this time the inhibitory centres are in a state of at least lessened activity, as is evidenced by involuntary movements, micturition, &c.; later the reflexes are lost. During this stage the blood pressure would appear to be lessened, the action of the heart accelerated, and the respiratory rhythm, at first quickened, subsequently slowed to a standstill. This state of things persists for awhile, and is accompanied by relaxation of some muscles, *e.g.*, the palatine and faucial muscles, while other muscles are the seat of arhythmic clonic and tonic contractions. Following upon this stage, we usually meet with the phenomena of recovery. At the present time I shall restrict my attention to these, because when the gas is pushed further the resulting action is a complex one, and largely due to want of access of oxygen. During the period of recovery, a further stage of excitement appears, and it is commonly associated with hallucinations, sometimes pleasant, sometimes extravagant. The senses soon become keenly upon the alert, and operative measures prolonged into this period give rise to the most intense

pain. Patients will declare the pain in such cases transcends that where no gas is given.

Here, then, is very briefly summarised a theory, at present inadequate and incomplete, of the action of nitrous oxide; to it I shall hope to return and to offer some further elaboration of a subject as difficult as it interesting, as complex as it is important.

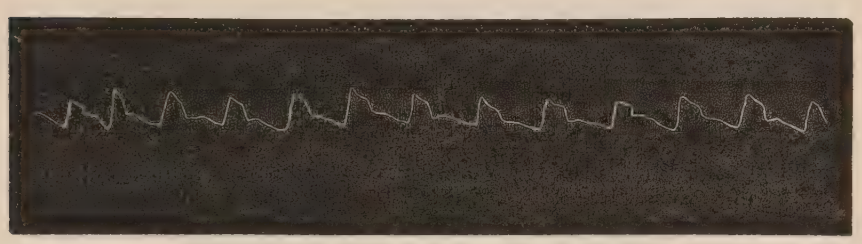


FIG. I.—Normal pulse, H.B.

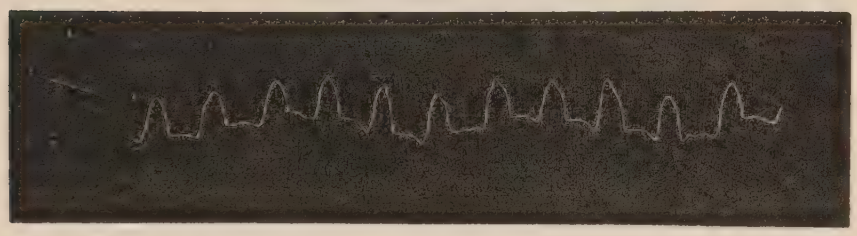


FIG. II.—Fully under nitrous oxide; shows no tidal wave; marked dicrotism, evidencing lowering of arterial tension.

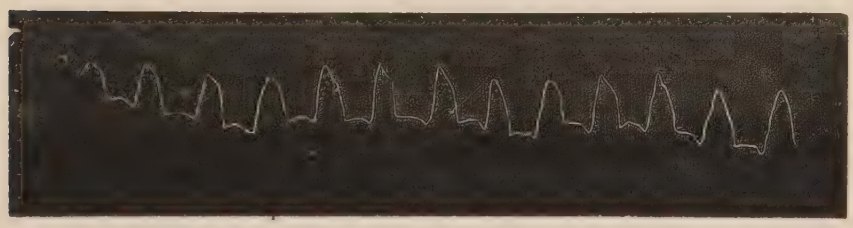


FIG. III.—Shows gradual resumption of normal characters during "coming to."

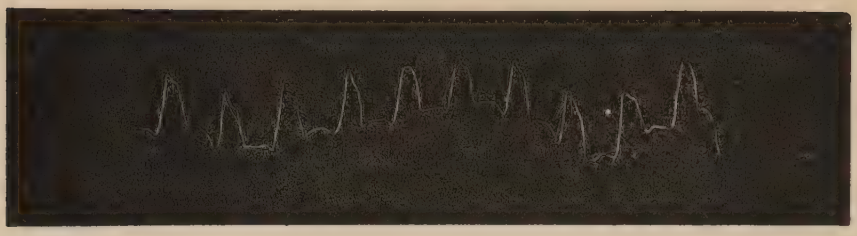


FIG. IV.—Continuation of III; tidal wave appearing.

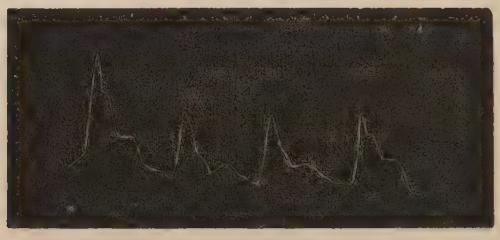


FIG. A. I.—Normal pulse.

FIG. A. II.—Under gas, (*a*) Shows marked acceleration of rate of heart beat; (*b*) also loss of tidal wave, evidencing lowering of tension.

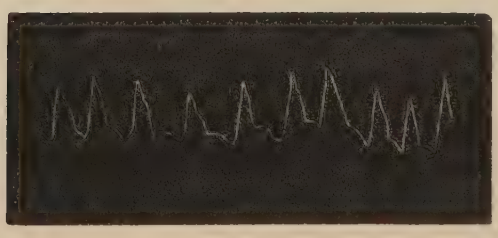


FIG. A. III.—This trace shows great acceleration of rate of heart beats, absence of tidal wave, acuteness of apices of curves, markedly increased respiration curves.

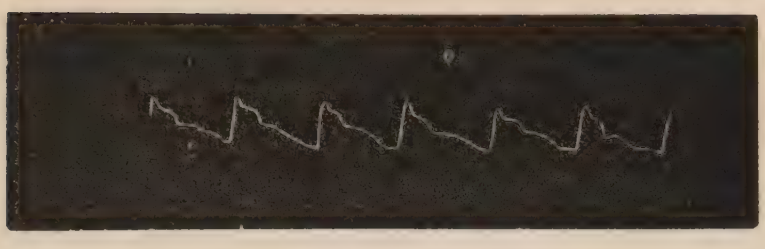


FIG. B. I.—Normal trace, H.S.

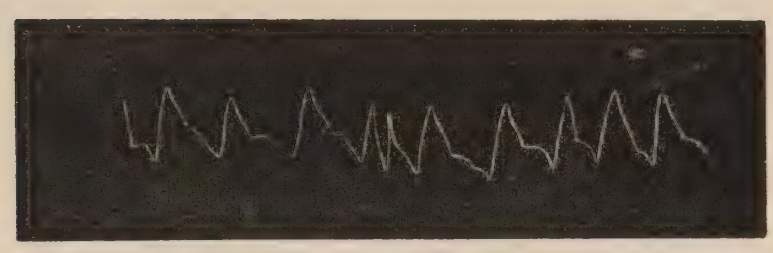


FIG. B. II.—Under—shows loss of tidal wave; pointing of apex; respiratory curves exaggerated; shows lowered tension.

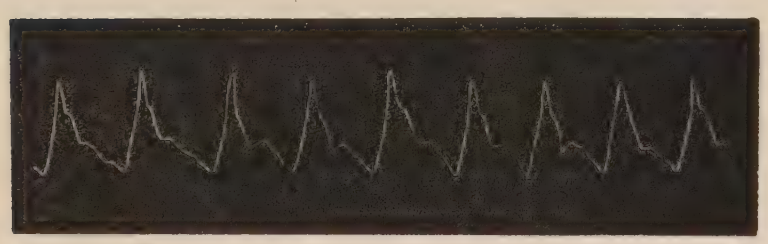


FIG. B. III.—Still under, beginning to come to.

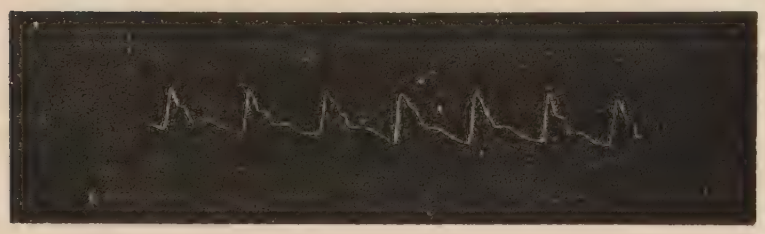


FIG. B. IV.—Resumption of normal beat.

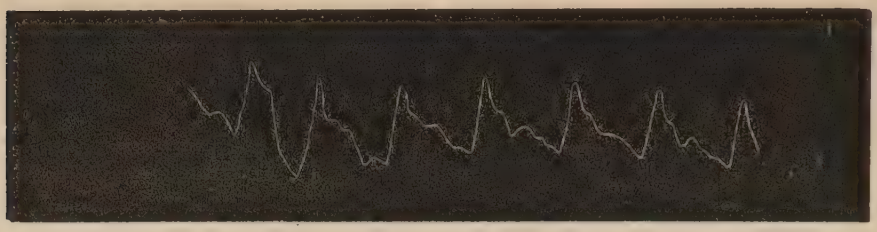


FIG. C. I.—Normal beat, shows tidal wave, aortic notch, dicrotic wave.

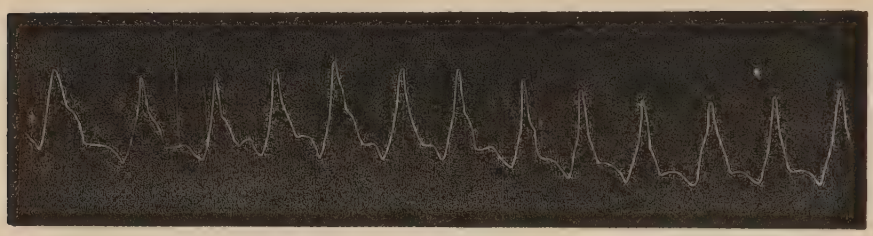


FIG. C. II.—Under nitrous oxide. Shows acceleration of heart beats; increased acuteness of curve; diminution of tidal wave; dicrotic wave occurs later, this is shown by being farther from apex.

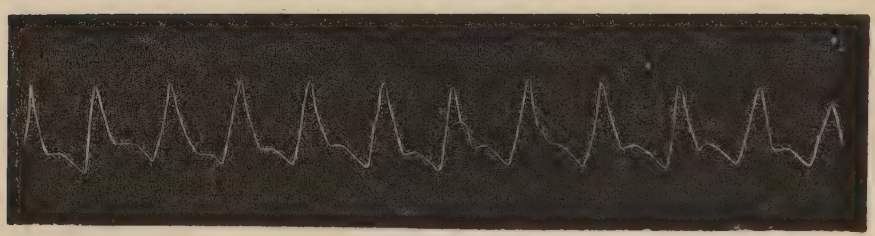


FIG. C. III.—Nearly same as II, but features more marked.

Discussion.

The President said the close attention with which the paper had evidently been followed by those present showed the great interest they took in the subject. He scarcely felt competent himself to criticize such a paper, at all events until he had had an opportunity of reading it carefully in print; but he saw several gentlemen present who had given special attention to the subject, and he should be glad to hear how far they agreed with the conclusions arrived at by Dr. Buxton.

Mr. Woodhouse Braine said he had listened with a great deal of pleasure to Dr. Buxton's paper, but unfortunately it only dealt with a part, and the least important part, of the subject, and it appeared to him that at present there was little or nothing to discuss. He thought it would be better to wait until they had heard the second part, and then discuss the subject as a whole. There was nothing in Dr. Buxton's paper, so far as he had gone, to which he personally was inclined to take exception.

Mr. Bowman Macleod agreed with Mr. Braine that it would probably be best to defer the discussion until they had heard the conclusion of the paper. Meanwhile, however, he wished to call Dr. Buxton's attention to a point to which he had not alluded, and of which he might not be aware. In the days when liquid gas was not so easily procurable as it was now, he (Mr. Macleod) had been in the habit of making his own gas, and he found that the first portion that came off when the nitrate of ammonia was heated was what was known as "laughing gas," and that after five minutes or so came the purer nitrous oxide as now used. He had collected this "foreshot" in a separate bag, and breathed it and found that

it produced intense exhilaration and uncontrollable excitement, whilst what came afterwards produced only placidly exhilarating, rapidly followed by narcotic effects. He hoped that Dr. Buxton would take the trouble to repeat this experiment, and, if possible, determine by careful analysis the exact composition of the foreshot and the cause of its peculiar effect on the system.

Mr. Tom Bird thought there were one or two points in the paper which might be profitably discussed without waiting for the concluding portion. The centre of the paper was the part which had interested him most, viz., that in which Dr. Buxton had described the effects of the gas on the patient. Now these effects varied considerably, as might be expected from the widely different conditions, mental and physical, of the patients, and this introduced a source of difficulty into such experiments as Dr. Buxton had attempted to carry out, since unless a succession of perfectly normal patients could be obtained it was impossible to obtain a perfectly normal set of results.

Then with regard to the comparison between the breathing of nitrogen and of nitrous oxide, he would remind Dr. Buxton that nitrogen was an insoluble gas, whilst nitrous oxide was not. The latter was taken up by the blood, the composition of which thus became changed.

Mr. S. J. Hutchinson said the Society was indebted to Dr. Buxton for a very complete essay on the physiology of nitrous oxide. He should be glad, however, if Dr. Buxton would give his authority for the statement that apnœa did not produce a form of anæthesia. There could be no doubt that Dr. Bonwill's method of breathing as rapidly as possibly until it could be kept up no longer, did produce a state of apnœa, and that this was accompanied by more or less anæsthesia.

It must not be forgotten also that the conditions of nitrous oxide narcosis differed greatly according as it was given with the expiratory valve closed or opened. In the first case, the gas and expired air being rebreathed, there was excess of

nitrogen with deficiency of oxygen, whilst in the other there was deprivation of oxygen.

Dr. Hewitt thought that facts pointed strongly to the conclusion that nitrous oxide acted in the same way as ether, chloroform, and other anæsthetics—*i.e.*, it was absorbed by the blood in the pulmonary circulation, was carried by it to the brain, and acted on the higher centres just as they did. Analysis of the products of respiration during administration of the gas showed that these consisted at first of nitrous oxide and expired air, and later chiefly of nitrous oxide, and that they did not contain any excess of nitrogen or of oxygen, showing that the gas was not decomposed in the blood. There could be no doubt, however, that in the ordinary mode of administration the anæsthesia produced was due to a double cause, it was partly the result of the narcotic effect of the gas, and partly asphyxial from deprivation of oxygen. The object to be aimed at was to get as much of the former and as little of the latter as possible, or at all events to delay it as long as possible. By M. Paul Bert's method the tendency to asphyxia was obviated altogether, and it could be delayed by the use of the supplemental bag.

If, when the gas was given, the expired air and gas was suffered to escape, a certain amount of the oxygen in the lungs was lost at each expiration until it was all gone; nitrous oxide alone was then presented to the brain centres, and the respiratory movements could no longer be carried on. But if, after washing out the lungs with nitrous oxide, the supplemental bag was used, a small quantity of oxygen was still supplied with each inspiration, and by this means anæsthesia could be maintained for a longer period. He had found by analysis that a two-gallon supplemental bag at the end of an ordinary administration still contained two or three per cent. of oxygen.

Mr. Henri Weiss said he had been greatly interested by the sphygmographic tracings which Dr. Buxton had exhibited, and he thought that others besides himself must have

learned with pleasure that the blood pressure was *reduced* during the administration of nitrous oxide, and not increased as had generally been supposed to be the case, and that there need not therefore be any hesitation in giving gas to individuals of full habit for fear of increasing the liability of apoplexy.

The PRESIDENT said he had also been greatly interested in seeing the effect of the gas on the circulation, as shown by the sphygmographic tracings, the more so since he had himself made some observations under the microscope, with reference to the effect of chloroform on the circulation of the frog. It acted as a very decided depressant, the blood current getting gradually slower until the corpuscles could be seen to regurgitate after each feeble pulsation, and at last became quite stationary. He must now call upon Dr. Buxton for his reply.

DR. BUXTON remarked that it would take more time than he had at his disposal to answer fully some of the questions put to him; he would therefore content himself with very brief replies to the criticisms which had been made on his paper. He was much obliged to Mr. Macleod for the hint which he had given him, and should take an early opportunity of trying to find out the cause of the difference to which he had called attention. The fact that nitrogen was an insoluble gas, whilst nitrous oxide was soluble, did not appear to him to be of much importance, or to throw much light on the problem they had to solve. He quite agreed with Mr. Bird as to the importance of eliminating as far as possible all sources of error in making experiments on individuals, and with this view all his own experiments had been made on personal friends and not on patients. He still held that apnœal states were not necessarily anæsthetic. Dr. Bonwill's plan acted by exhausting the nervous system for the time, just as any great muscular exertion would do.

Dr. Hewitt said that nitrous oxide circulated as a gas. He (Dr. Buxton) had not been able to obtain any proof of

this, nor did he know that any one else had succeeded in doing so. Dr. Frankland, indeed, in the course of the experiments on rabbits referred to in the paper, had found that the products of respiration contained a slight excess of nitrogen, which might possibly be an indication that the part played by nitrous oxide in the system was not quite as simple as Dr. Hewitt seemed to think; otherwise, the views expressed by Dr. Hewitt agreed very closely with his own, since the aim of his paper had been to show that the anæsthesia produced by nitrous oxide was central—due to changes in the cortical cells of the brain—that the end organs had nothing to do with it, and that the phenomena produced by it were altogether distinct from those produced by ordinary asphyxia. In the first place the effect was much more rapid. Had any one known insensibility to be produced by asphyxia in half a minute? And in the next place, when the oxygen of the blood was exhausted so as to produce asphyxia, the respiratory centres in the medulla became paralysed and the movements of respiration ceased; whilst under gas complete insensibility co-existed with regular breathing. He thought there was sufficient evidence to show that nitrous oxide acted as a stimulating narcotic, though no doubt some of the symptoms produced during the ordinary mode of administration were due to partial asphyxia. There was also the important fact that the state of the circulation during nitrous oxide narcosis was absolutely distinct from that produced by asphyxia, and any one who wished to prove that nitrous oxide acted simply by producing a state of partial asphyxia must be prepared to invalidate the evidence he had brought forward in proof of this difference.

The PRESIDENT then thanked Dr. Buxton on behalf of the Society for his paper. The applause which he heard testified to the pleasure which the paper had afforded, and he felt sure that the promised continuation would be looked forward to with great interest.

The next meeting, on April 5th, would be entirely devoted to Casual Communications, and of these there was already a

good supply offered by Messrs. Walker, Walter Coffin, Newland Pedley, Maggs, Hutchinson, Redman, Boyd Wallis, Henri Weiss, Chas. Tomes, and Betts, with a probability of further additions to the list before the date of the meeting.

The Society then adjourned.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

April 5th, 1886.

T. CHARTERS WHITE, M.R.C.S. & L.D.S.Eng.,
President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

Mr. Henry Kluht signed the Obligation Book, and was formally admitted to membership by the President.

The following candidates were then balloted for and elected members of the Society, viz.:—

Messrs. Charles Moulden Bayfield, L.D.S.I., 9, Talbot Road, Westbourne Park, W.; and
Charles M. Cunningham, D.D.S. Michigan, 2, King's Parade, Cambridge.

The President related the following case which had come under his notice that morning. A lady came to consult him with reference to a lower partial denture which had been made for her five or six years ago, but which for two years past she had been unable to remove from the mouth. It carried the four lower incisors mounted on vulcanite, but was so encrusted with tartar that it was impossible to tell what it was made of until after its removal. It had originally been secured by wire bands to the adjacent canines, but these teeth soon loosened and came out; the patient, however, still continued to wear the plate, which she managed to retain in place by the muscular pressure of the lower lip. As the result of this pressure the mucous membrane opposite the

spaces where the canines had been became greatly hypertrophied, and the spaces became filled by two large masses composed of swollen and hypertrophied mucous and fibrous tissue. On the right side the mass had completely surrounded the wire band, which appeared to perforate it, and the plate could not be removed until this had been divided. Mr. White said he had never met with a precisely similar case, and thought, therefore, that it might be interesting to the Society.

Dr. Walker exhibited a very instructive series of specimens illustrating the various stages and adaptations of Continuous Gum Work, and commented upon them.

Every member of the Society must, he said, have at least a theoretical acquaintance with the preparation of continuous gum work, since it was described in every text-book. But in this, as in most other processes, practical success depended on attention to a number of details; hence an inspection of the specimens he had to show, illustrating the various stages of manipulation as carried out by means of Verrier's furnace, might be useful to some of those present, though he had nothing new or original to bring forward. He thought the thanks of the profession were due to Mr. Verrier for his furnace, by means of which it was now possible to prepare partial or full continuous gum dentures with but little expenditure of time. With this furnace he (Dr. Walker) was able to obtain what he considered, and what he hoped those present would consider, very satisfactory results.

The principal objections which had been brought against continuous gum work were the alleged difficulty of repairing or adding to a denture, and its weight. He would hand round specimens showing that it was quite possible to repair or add to a continuous gum denture, and would call attention to the lightness of the combined work,—vulcanite denture with continuous gum mountings,—prepared according to Mr. Balkwill's method. Some practitioners also complained of finding it difficult to get an accurate fit; he had therefore placed some of the cases on the models to show the fit.

He had used several makes of gum body and enamel—

American, German, and English. The latter, supplied by Messrs. Ash, he had as yet used only a few times, but had found it quite satisfactory. With the American composition of the S.S. White Company, American teeth must be used, but Messrs. Ash's teeth could be used with their gum body and enamel, which fused at a somewhat lower temperature than the American.

Dr. Walker then proceeded to show the various stages of the work as applied to partial plate-mounted dentures, partial bar-mounted dentures, and full sets, the mode of fixing the teeth, applying the gum body, firing and enamelling. The colour of the finished denture depended partly on the make of the enamel, but chiefly on the quantity used. Thus, if a light colour was required, only a thin coating of enamel should be applied, whilst for a deep colour a thicker coating should be given, or several coatings with a firing between each.

To prevent cracking of the enamel in the case of full dentures a platina lining should be adjusted to the back of the teeth after they are set up, and the pins of the teeth bent over the upper edge. The lower third of this lining is cut into sections, which are bent alternately to the outer ridge of the alveolus and to the inner circle of the palate. By this means the effects of the expansion of the metal by heat and its contraction on cooling are equalised, and since he had adopted it he had not had one cracked tooth.

He had discarded the use of the platina table in the muffle, and now surrounded the denture in the muffle with powdered silex. In the case of a full denture it was not advisable to attempt to fire the whole at one heating. It was better to fuse the alveolar border first, then to reverse the position of the piece in the muffle and fire again to fuse the palate.

He should be very pleased to give further particulars, and to answer any questions respecting the management of the furnace, gas supply, &c., after the meeting.

The PRESIDENT said it was certainly very beautiful work, but it seemed to him that there was a difficulty in making

alterations and repairs, at all events as compared with other descriptions of work, and that this was a drawback. He had, however, to confess that he had never tried it himself, and he should be glad to hear the opinions of those who had a practical acquaintance with it.

Mr. Walter Coffin said he had found continuous gum work very satisfactory for partial plates, but had always failed in his attempts to make a complete denture, owing to the difficulty of getting it properly and evenly fused. He had to thank Dr. Walker for showing him how to overcome this difficulty.

Dr. Geo. Cunningham remarked that when he brought the subject before the Society earlier in the session it was to complain of his failures, but he was happy to say that since then he had been more successful. He had suggested that the gum body supplied by the S.S. White Company must be different from that which he had previously obtained from them, and this he found was actually the case. They had been in the habit of selling a preparation made by Dr. Close, of New York, but lately they had taken to make it themselves, and no doubt the two were not quite identical in composition. Unfortunately the materials required in continuous gum work were troublesome to prepare for oneself, and it was therefore necessary to rely on those supplied by the depôts.

Dr. Walker had suggested that his failure had been caused by deficient gas supply, but this he found not to be the case. In fact, his supply was fully equal to what Dr. Walker had said was necessary. The S.S. White Company, to whom he had written, replied that the "checking" of which he complained would occasionally occur under all circumstances, and that they were quite at a loss to explain it. With regard to the case which he had mentioned at the January meeting as having turned out so bad a colour, he had set a boy to grind off the enamel, re-enamelled it, and fired twice as Dr. Walker had recommended, first with the molars to the front, and then to the back of the furnace, and the result was most satisfactory. In fact, the patient was so pleased

with it that he could not be induced to part with it even for the purpose of showing it at that meeting.

He quite agreed with Dr. Walker as to the wisdom of discarding the false floor to the muffle, and he had heard that Mr. Verrier had himself given it up.

Dr. Walker, in reply, said that alterations and repairs could be effected in this description of work without remaking, and without any great difficulty. He had himself found that Dr. Allen's gum body, obtained from the S.S. White Company, gave a different result after being kept a year from that which it gave when fresh. All the same, though the composition of the materials was given in Harris's book, he did not think it was worth while for any practitioner to attempt to make them for himself.

Mr. Walter Coffin showed models of a regulation case treated by his brother, Mr. Harold Coffin, by means of an expansion plate, which was interesting on account of the very successful result obtained under what appeared at first to be most unfavourable conditions, especially considering the age of the patient.

The patient, an Oxford undergraduate, in his twenty-fifth year, had great narrowing of the arch in the premolar region; indeed the falling in was so marked on one side, where the canine was forced completely outside the arch, as to cause a decided malformation of the face. To have extracted the canine, as he thought many practitioners would have done, would have aggravated the deformity. As the result of five months' treatment the teeth had been expanded into line, and the appearance of the patient very greatly improved.

The President said he agreed with Mr. Coffin in thinking that most practitioners would have begun by extracting the misplaced canine. The result obtained was certainly most satisfactory, and should encourage others to persevere in the use of the expansion plate even in apparently unpromising cases.

Dr. St. George Elliott showed several contrivances which he had found useful in practice. One was a small parafine

lamp, over which a tumbler could be placed; it would burn for a long time, and the temperature of the water did not vary more than 6° Fahr. A rotary knife fitted to the dental engine for cutting crystal gold; points made of raw hide, which was tougher than leather, for polishing gold fillings; and a neat little oil can made of celluloid with platinum nozzle.

The PRESIDENT thanked Dr. Elliott for giving him a very useful hint with reference to cutting crystal gold. He had been in the habit of tearing it, but Dr. Elliott's plan was much neater, and he should certainly adopt it.

DR. GEO. CUNNINGHAM (Cambridge) read notes of a case of tetanus supposed to have been caused by dental irritation.

The patient was a healthy muscular Cambridge undergraduate, aged nineteen. Early in November, whilst eating some meat, he bit upon a fragment of bone which was driven into a carious cavity in the left upper first molar, causing extreme pain of short duration. A few weeks afterwards he returned home for the Christmas vacation and went about a good deal. On January 20th he rode home from a dance outside a cab, the night being bitterly cold. Next day he had a good deal of pain in the carious molar, and went to the family dentist, who filled the cavity (mesial crown, of medium size) with amalgam. Next day (January 22nd) he returned to Cambridge, and on the 25th felt a stiffness in his lower jaw. As this stiffness continued he (on the 29th) consulted Mr. Geo. Wherry, of Cambridge, who did not then consider the case a serious one. On the 31st, the symptoms having become more marked, he consulted Mr. Wherry again. He complained of pain on the left side of the face, and pain and difficulty in moving the lower jaw caused by contraction of the masticatory muscles. He could open his mouth, but not widely. Mr. Wherry, thinking the spasm might be due to an impacted wisdom tooth, sent the patient to Dr. Cunningham. Dr. Cunningham found the teeth strong and very free from decay, but much crowded. A careful examination convinced him that the trouble was not due to the wisdom teeth. The left upper first molar was

found to be slightly sensitive to percussion, and had been the seat of slight localised pain, so the amalgam filling was removed and a minute exposure of the pulp was discovered. A dressing of carbolised resin was applied.

This, however, had no effect on the progress of the trismus. On February 3rd there was marked spasm of the facial muscles (*risus sardonicus*), and the patient stated that though he could swallow liquids well he had been unable during the last two days to swallow any solid food. On the 5th the spasms had extended to the muscles of the neck, thorax, and abdomen, and it was decided to extract the tooth which was suspected of having caused the mischief; this was done under chloroform, the corresponding lower molar being also extracted. The disease, however, continued to progress. The muscles of the chest, abdomen, and back were involved, and violent fits occurred in which all the muscles of the trunk and limbs seemed to be contracted with the severe pain which accompanies cramp.

For some days the patient remained in a critical state, but was able to take fluid nourishment, and his strength was thus fairly maintained. The contraction of the masticatory and facial muscles was evident even during sleep; on two occasions he bit his tongue badly. The general spasms were often brought on by attempts to talk, to pass water, or to relieve the bowels. The temperature was never very high. During the third week the spasms extended to the legs and thighs, following therefore the same order as is seen in rigor mortis. The patient then began to improve and slowly recovered.

The treatment pursued consisted of rest in bed, chloral hydrate internally to relieve spasm, and extract of belladonna externally, applied hot to the jaws and neck. Great attention was also paid to the diet,—milk, beef-tea, raw beef juice, cream, beaten-up eggs, &c., were administered at frequent intervals. The tooth was extracted to remove a possible source of irritation.

Whether the case was of idiopathic or traumatic origin must be considered an open question, and he (Dr. Cunningham) should be glad to hear the opinion of members on this point.

Mr. Storer Bennett asked whether Dr. Cunningham had examined the pulp after the tooth had been extracted, and whether there was anything sufficiently wrong with it to assist in accounting for the origin of the malady.

Mr. Betts remarked that pathologists appeared to be very uncertain as to the causes of tetanus. Laceration of a nerve seemed to be the most common cause, and it was possible that in this case the disease might have been originated by the irritation set up by the spiculum of bone. Considering, however, that irritation and laceration of nerves was a common occurrence in dental practice, it was remarkable that tetanus should be so rarely met with.

The President remarked that the case was of great interest, since tetanus was an occasional, though rare, consequence of dental irritation. Still, his own opinion of this particular case was that the facts pointed to idiopathic rather than to dental origin of the disease.

Dr. Cunningham replied that so far as could be judged from a naked eye examination of the pulp it was not greatly altered —it appeared congested only. The exposure of the pulp was very minute, and he did not think that any actual laceration could have been caused by the fragment of bone. The fact that extraction of the tooth was not at once followed by an amelioration of the symptoms was no proof that the disease was not of dental origin, since the disease when once set up was not easily quieted. But whether the dental lesion was the cause of the disease or not, he thought it was bad practice to put in an amalgam filling in such close proximity with the pulp without the intervention of any non-conducting material.

Mr. C. J. Boyd Wallis then read notes of the following case of facial neuralgia and spasm, illustrating the suffering that may arise from diseased and neglected teeth.

A lady, aged thirty-two, thin and pale, and evidently in delicate health, was sent to him by a medical friend for advice concerning her teeth. She stated she had been suffering severely for some time from neuralgia with occasional pain in one or other of her molar teeth, all of which were more or less

decayed. In addition to the neuralgia there was contraction of the muscles of the right side of the face, the nose being drawn to the right, with loss of power in the eyelid and some loss of sensation over the side of the face and extending down the outer side of the right arm. Tonics and change of air had been tried with little or no benefit.

Upon examination of the mouth Mr. Wallis at once advised the removal of the right upper second molar,—which was abscessed,—and the root of the third molar; the right lower second bicuspid, left upper molar roots, and lower wisdom tooth; they were accordingly extracted under gas and ether. All of them were completely broken down with decay; but though the pain about the head and neck had been more or less constant during the previous six weeks, it had not been localised to any one tooth for more than a few minutes at a time. Mr. Wallis therefore decided to remove the teeth which were most useless and most likely to be giving rise to reflex nerve irritation.

The patient was advised to continue for a short time longer the tonic ordered by her medical attendant, and shortly afterwards wrote to say that she was quite free from pain, her face had regained its normal condition, and her general health had greatly improved.

Mr. W. A. Maggs read notes of two cases of Epulis treated by ligature.

Case 1.—He was consulted by a young lady, aged twenty, concerning a growth connected with the left side of her lower jaw which had been termed "Cancer" by her regular medical attendant. It sprang from a point between a root of the first permanent molar and the second temporary molar, which still persisted. The growth was about the size of a walnut, lobulated and pedunculated; its surface was ulcerated from contact with the opposing upper teeth, and there was some inflammation about the base.

Mr. Maggs extracted the temporary molar, and the adjoining stump, put a double ligature round the peduncle, and told the patient to return in three days' time. By that time

the growth had sloughed away, only the ligature remaining. Mr. Maggs removed this, applied solid nitrate of silver to the part and ordered a mouth wash containing chloride of zinc (gr. v. ad Aq. fl. ℥j). The treatment was perfectly successful.

Case 2.—A gentleman, aged fifty, sought Mr. Maggs' advice respecting a growth springing from the region of the left upper second bicuspid. He had previously consulted two medical men, neither of whom would venture on a diagnosis. The growth was about the size of a filbert, and slightly pedunculated. The teeth on either side of the second bicuspid had been extracted some years before. Mr. Maggs removed the tooth and applied ligatures to the base of the tumour as in the previous case, and the treatment was equally successful.

He regretted that he had been unable to determine microscopically the structure of these tumours, but he assumed that they were of the ordinary fibrous description. And seeing that the great majority of such cases were of this nature, was it not wiser to adopt some such simple mode of procedure as that described, rather than the excision of the alveolus which was usually considered the only sound treatment? He had a vivid recollection of the formidable operation, and excessive hæmorrhage, that usually attended the removal of such growths at the hospitals, and it appeared to him that if such heroic means were necessary, it should only be in cases where the ligature had failed. In each of these cases nearly two years had elapsed, and there had been no recurrence.

The President said he was disposed to agree with Mr. Maggs in protesting against the adoption of heroic treatment in all cases of epulis. No doubt the use of the bone forceps, actual cautery, &c., was sometimes necessary, but cases did often occur in which, as Mr. Maggs had pointed out, simpler measures would suffice, and it was well, therefore, that some discretion should be used, and that all should not be condemned to undergo a somewhat severe operation as a matter of course.

Mr. Betts remarked that Mr. Maggs was fortunate in

meeting with pedunculated tumours; they were more often sessile, and then the ligature was not applicable. In such cases he had found the application of ethylate of sodium very satisfactory; it destroyed the growth and caused no pain. In one case the application was followed by some hæmorrhage, which was arrested by styptics, but three applications of the ethylate completely removed the tumour, and there had been no recurrence.

Mr. Hepburn thought that the growths spoken of by Mr. Maggs were rather of the nature of polypi than of epulis. The former might safely be excised, and if the source of irritation was removed there was little chance of recurrence. But in the case of epuloid growths it was necessary not only to remove the root or tooth which appeared to have given rise to it, but also thoroughly to clear out the socket whence it came.

Dr. Walker mentioned the case of a lady who suffered during four successive pregnancies from a vascular granulating growth of an epuloid character; there was frequent and very troublesome hæmorrhage. Dr. Walker managed to keep the growth in check by means of chloride of zinc. In the intervals between the pregnancies it was quite quiescent and caused no inconvenience.

Dr. Cunningham thought that Mr. Maggs applied the word epulis to something very different from what was usually understood by the term. As regards epulis proper he was of opinion that mild treatment was not only useless, but seemed generally to aggravate the disease. As an instance of this he referred to a case in which his late partner excised an epulis and it recurred within a year in a worse form.

Mr. Storer Bennett said it was a fact well established by experience that mild operations were of no use in cases of true epulis; it was necessary not only to remove the growth, but also the portion of periosteum whence it sprang. What Mr. Maggs had spoken of as "epulis" were evidently cases of simply hypertrophy of the gums, which were easily treated.

It was specially important to guard against all chances of recurrence in a case of epulis occurring in a person of middle age, such as Mr. Maggs' second patient, since if a recurrence did take place under these circumstances it was very likely to be of a more malignant character than the original growth.

Dr. St. George Elliott remarked that most of the previous speakers had admitted that some fibrous tumours of the gum might be successfully got rid of by comparatively simple treatment, though they asserted that others required what was, to the patient at least, a decidedly formidable operation. But who was to decide what the operation was to be? He would instance the case of a young lady who consulted a well-known London hospital surgeon with reference to an epulis over the left upper lateral. He told her that it must be excised. The patient then applied to him (Dr. Elliott); he painted it two or three times with ethylate of sodium, and at the end of a month the tumour had completely disappeared and did not return.

Mr. Hern thought that as a rule the so-called "heroic" treatment was best. He remembered tying an epulis for a patient at the Dental Hospital; at the next visit, the growth showing no signs of separating, he transfixed the pedicle and tied each half. As the result of this one half sloughed and the other half was not affected, and finally the growth had to be removed with the knife. The pedicle was very dense and contained spicula of bone.

Mr. A. Underwood remarked that it was difficult to be quite sure of the nature of these growths; some were simple and non-recurrent, whilst others were decidedly of a malignant character. The naked-eye appearances, especially, were very deceptive. Under these circumstances he thought it was best to operate in such a way as to reduce the chances of recurrence as much as possible, especially in persons at all advanced in life.

Mr. Boyd Wallis referred to two cases of epulis treated by electrolysis which he had brought before the Society about

two years ago, models of which would be found in the Museum. No recurrence had taken place.

Mr. Walter Coffin said he had met with one case of epulis which had been successfully treated by electrolysis. He had heard it stated—he did not know whether it was true—that treatment by electrolysis, even if not successful in removing the tumour, did not aggravate it, as incomplete surgical operations not unfrequently did, and this, if true, was certainly an advantage.

Mr. Maggs, in reply, said that doubts had been expressed as to whether the cases he had described were cases of epulis. The term was not capable of very strict definition, but he was equally in doubt as to whether the cases mentioned by Messrs. Walker and Betts were cases of epulis; he should have said they were rather of the nature of vascular growths. He wished to point out that in each of the cases he had reported he had removed the teeth which appeared to have given rise to the growths. This would be followed in due course by the absorption of the alveoli, and therefore it appeared to him unnecessary to interfere surgically with parts which would if left alone be removed by a natural process, and he still thought that, at all events where the growth sprang from a limited base, the treatment he had adopted was sufficient.

The President then thanked those who had brought forward communications during the evening, remarking on the instructive character of the cases and on the amount of discussion they had elicited.

He thought it might be interesting to the members to hear that as President of the Society he had received an invitation to be present at the laying of the foundation stone by the Queen of the new Examination Hall of the Royal Colleges of Physicians and Surgeons on the Embankment.

At the next meeting (on May 3rd), Mr. Storer Bennett would read a paper describing some of the chief recent additions to the Museum.

The Society then adjourned.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

May 3rd, 1886.

T. CHARTERS WHITE, M.R.C.S., & L.D.S.Eng.,

President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

Mr. W. J. England signed the Obligation Book, and was formally admitted to membership by the President.

The President announced that the following gentlemen had been nominated as candidates for membership, and would be balloted for at a subsequent meeting, viz.:

Messrs. Humphry Wingfield Tracy, L.D.S.Edin., 6, Hatter Street, Bury St. Edmunds;
Peter Crank, L.D.S.Eng., 7, Castle Street, Canterbury; and
Albert J. Kutz, L.D.S.I., D.D.S., 32, Wimpole Street, Cavendish Square.

The following candidates were then balloted for and elected members of the Society:—

Messrs. Albert Edward Clayton Woodhouse, M.R.C.S., and L.D.S. Eng., 1, Hanover Square, W.; and
Murray Davis, L.D.S.Eng., Wimpole Street, Cavendish Square, as Resident Members.

George G. Campion, L.D.S.Eng., 264, Oxford Road, Manchester; and
Horace J. Lloyd Farebrother, L.D.S.Eng., of Salisbury, as Non-resident Members.

Mr. Willoughby Weiss showed the head of a lamb with hare-lip on the right side which had been sent as a donation to the Museum by Mr. J. T. Fripp, of Willesden. The specimen had been admirably preserved and mounted by Mr. Sutton. The fissure did not extend to the palate.

The President said the thanks of the Society were due both to Mr. Fripp for his interesting specimen, and to Mr. Sutton for mounting it. It afforded further proof of the fact to which their attention had been called by Mr. Sutton, that man did not monopolize all the abnormalities.

Mr. Betts exhibited models of the upper and lower maxillæ of a boy aged five-and-a-half years, remarkable for the extreme smallness of the dental arches, and from the fact that the upper incisors had never erupted, whilst three of those in the lower jaw fell out when the child was two-and-a-half, the remaining one being loose at the time of taking the impression. The boy, though delicate-looking, was not under-sized, but the lower portion of his face was disproportionately small.

Mr. J. S. Turner showed an upper left lateral the labial portion of the root of which was absorbed to such an extent as to lay open the canal. He had extracted it from the mouth of a boy aged twelve-and-a-half, who came to him complaining of pain in the upper teeth which could not be localized, and the cause of which appeared very obscure. The teeth were large, sound, and not crowded. Bearing in mind a case which had been brought before the Society a short time before by Mr. White, of Norwich,* Mr. Turner extracted the lateral and found the state of things now seen. On passing a probe into the alveolus the lingual surface of the canine could be felt. It was the pressure of this tooth coming down in front of the other which had caused the absorption and

* See "Trans." for March, 1885, p. 148, and May, 1885, p. 228.

exposure of the pulp, though previous to the extraction of the lateral there had been no indication whatever of its presence. He, Mr. Turner, thought that this case showed clearly the benefit which might be derived from attending the meetings of the Society, for had it not been for his recollection of Mr. White's case he should not have thought of extracting the lateral, and in all probability the case would have completely baffled him.

The PRESIDENT remarked that absorption of the roots of the second molar from the pressure of a misplaced wisdom tooth was not a very rare occurrence,—several such cases had been brought before the Society,—but the condition described by Mr. Turner was much less common; he himself had never met with such a case. It required a considerable amount of assurance to extract an apparently sound tooth, such as this was, and he congratulated Mr. Turner on his powers of diagnosis.

MR. NEWLAND PEDLEY showed a patient on whom he had operated for cyst in the upper jaw, together with a plaster cast of the tumour before operation, and read notes of the case.

The patient, a man aged forty-two, had been suffering for four years from a gradually increasing swelling of the left side of the face. He consulted a medical practitioner, who, after a somewhat hasty examination, pronounced the growth to be malignant, and advised its total removal. Not feeling satisfied, the patient then applied to Mr. F. V. Mackenzie, of Kentish Town, and at his request Mr. Pedley was called in consultation. The swelling, which was as large as a hen's egg, extended as high as the margin of the orbit. There had never been any foul discharge from the nasal passages, nor any symptoms of inflammation of the antrum. Within the mouth a large sausage-shaped swelling could be felt in the buccal sulcus, very tense, but yielding a sense of fluctuation on firm pressure. As the result of his examination Mr. Pedley came to the conclusion that the disease consisted of a simple cyst, and proceeded at once to operate, making a

free incision, an inch and a half in length, along the alveolar margin, and turning out the contents, which were of the usual semi-gelatinous character, and loaded with yellow shining masses of cholesterine.

The cavity was syringed daily with antiseptic and astringent lotions, and the opening kept patent. Only about three weeks had elapsed since the operation, but the deformity of the face had almost completely disappeared.

Mr. Pedley remarked that a point of interest in connection with the case was raised by the question whether so large a cavity in this region could exist independent of the antrum, and whether the antrum had been involved. He should be glad to hear the opinions of members who had taken the trouble to examine the patient.

The President remarked that patients suffering from swellings about the jaws and palate were always imagining that the disease must be cancer, though in the majority of cases they were not malignant, but could be traced to the irritation of some carious or dead tooth. Could any such cause be assigned in the present case ?

Mr. Pedley replied in the negative.

Mr. Chas. Tomes related the following interesting case of replantation.

A boy had an upper lateral and canine knocked out at school. No attempt was made to replace the teeth at the time of the accident, but the boy mentioned it when writing to his mother, and she gave directions that he should come to London to have the teeth replanted, and he was accordingly brought to Mr. Tomes five days after the accident. Mr. Tomes felt very doubtful of success after so long an interval, but determined to make the experiment. He therefore removed the pulps of the two teeth, filled the pulp chambers and canals with gutta-percha, and then tried to replace them in their sockets; but this was found to be impossible owing to the contraction which had taken place. He found, however, that the lateral fitted very well into the socket of the canine,

and as there was a good deal of crowding, the loss of one tooth was not altogether an evil. The lateral was secured in place by means of a gutta-percha splint, and soon became firm. When last seen, six weeks after the removal of the splint, there was slight retraction of the gum about the neck of the tooth, but no sign of irritation, and the boy did not spare it. Of course time alone would show to what extent this experiment could be considered really successful.

Mr. Tomes also gave an account of an experiment he had made on himself with cocaine.

Being troubled with a tender tooth, he thought it would be a good opportunity for trying the effect of the new remedy. He accordingly dissolved a grain of the hydrochlorate of cocaine in a small quantity of water and injected it at the reflexion of the mucous membrane of the cheek and lower jaw just below the tender tooth. The result was an area of anæsthesia about as large as a five-shilling piece, but it did not abolish sensibility in the tooth. Shortly afterwards, whilst engaged in writing, he became conscious of a most unpleasant feeling of giddiness and nausea, his hands became cold and clammy, and on getting up to pour out some brandy he was slightly unsteady in walking. The symptoms soon abated, without his taking the stimulant, but a feeling of discomfort and nausea persisted for between two and three hours. He thought it well to call attention to the possibility of such effects being produced even by a dose of one grain, since he had seen the injection of a grain and a half and two grains recommended, and judging from his own experience it seemed to him that these doses might be attended with very unpleasant effects in some cases.

Mr. Newland Pedley said he was in the habit of injecting cocaine daily, and had met with no unpleasant after-effects as yet. The great majority of patients said they felt no pain from the subsequent extraction, but he freely admitted that some allowance must be made for mental effect. Thus in one case he painted the gum with carbolic lotion, assuring the patient that it would deaden the pain, then extracted two

large teeth, and the patient declared that he did not feel it. At the same time he had no doubt that the cocaine had a good effect in most cases. Thus, in one instance he broke a molar in trying to extract it, and the patient suffered acutely; he then injected cocaine and removed the roots, which were very firmly implanted, and the patient suffered no pain.

Mr. Boyd Wallis said he was in the habit of using cocaine pretty extensively, and in most cases with very satisfactory results. He had no doubt that it did obviate, or greatly lessen, the pain of extraction. Thus, finding it necessary to get rid of his own left lower canine, he had cocaine injected four minutes before the extraction and felt very little pain; he believed that if the operator had waited two minutes longer he would not have felt it at all. Another very satisfactory case was that of a dog, one of whose lower canines he was requested to extract. He injected cocaine, and removed the tooth, which was quite firm, without the animal giving utterance to a sound. He found it answered best for front teeth, since in the case of back teeth it was more difficult to inject the solution.

Mr. J. S. Turner remarked that it was impossible to obtain trustworthy results from experiments of this kind if the patient was informed of the object of the application. The late Mr. W. G. Bennett made a number of experiments with electricity as a means of obtunding sensibility before extraction, and obtained very satisfactory results. At last he thought of disconnecting the wires from the battery, the patient being aware of the effect they were intended to produce, and the result was still successful. In fact, it was well known that with the majority of patients the most surprising results could be obtained by working upon their imagination. If reliable results were desired, the patient should not be informed of the object of the experiment.

Mr. S. J. Hutchinson said it might be well to remind those who had not yet tried cocaine in dental practice, and who might be desirous of doing so, that a freshly prepared solution

should always be used, since it would not keep; in fact, it soon became absolutely poisonous.

The PRESIDENT said he was sorry Mr. Hunt, of Yeovil, was not present to give his experience of the value of cocaine in cases of extraction. He understood that Mr. Hunt had used it largely, with very satisfactory results.

He could fully endorse what Mr. Hutchinson had said as to the importance of using only a freshly prepared solution of cocaine. He had been astonished at the rapidity with which dense masses of fungus developed in it.

MR. J. H. REDMAN, of Brighton, exhibited and presented to the museum several specimens of abnormal teeth, including two good examples of three-fanged lower molars, a wisdom tooth with four fangs, another with roots bent at right angles, which of course was not extracted without difficulty, geminated roots of deciduous central and lateral incisors, and several specimens of calcification of the pulp. One of the last-named specimens belonged to a lady, several of whose teeth had been found to be similarly affected, and another to a patient who was suffering from ptosis, which soon disappeared after the extraction of the tooth.

Mr. Redman showed also a lower bicuspid, the root of which had been absorbed, and to which the following history attached. About a month before the tooth came out the patient accidentally bit upon a shot; this caused severe pain in the tooth, which lasted for several days. The tooth then became loose, so much so at last as to be a source of considerable annoyance, and the patient removed it.

He then read notes of the following instructive case of necrosis of the lower jaw.

A man, aged thirty, came to him with a very tense hard swelling on the left side of the face, extending well down the neck; the angle and base of the lower jaw could not be felt. The patient complained of severe deep-seated pain, great difficulty in moving the jaw, and bad taste in the mouth from the constant presence of pus. He had been attended for some considerable time by a country doctor, who had

ordered various kinds of outward applications, but had never examined the mouth, though the swelling had been steadily increasing in size.

On examination Mr. Redman found that all the teeth were perfectly sound, with the exception of the first lower molar, which was badly decayed and the pulp dead. An alveolar abscess had resulted, and its career being unchecked, the pus had infiltrated into the spongy part of the bone, which in this region is deep, causing necrosis of the whole of that side, from the ascending ramus to the symphysis. The teeth, from the wisdom tooth to the central incisor, were so loose that they could be removed with the fingers. A sinus opened near the wisdom tooth, another near the first molar, and a third opposite the lateral incisor, through all of which pus of a most offensive character exuded, and on passing down a probe the bone could be felt completely denuded of periosteum and partly detached. Fortunately, no opening existed through the cheek, although every effort had been made to promote one.

Mr. Redman removed the teeth, which were bathed in pus, and about a week later the necrosed portion of bone exfoliated in three pieces. The patient made a good recovery, scarcely any disfigurement resulting.

The case showed the serious mischief which might result from what was usually considered a very trifling ailment, viz., alveolar abscess, and the importance of calling in dental aid in all cases of swelling and pain in the region of the jaw. An examination of the mouth seemed often to be the very last thing thought of by the ordinary medical practitioner, instead of which the state of the teeth should be at once ascertained in any case at all resembling the above.

The PRESIDENT then called upon Mr. Storer Bennett to read his paper "On some Recent Additions to the Society's Museum."

On some Recent Additions to the Museum of the Odontological Society.

By Storer Bennett, F.R.C.S., L.R.C.P.Lond., L.D.S.Eng.,
Hon. Curator of the Museum.

Mr. President and Gentlemen,

The Museum of this Society has lately been enriched by the addition of numerous specimens of normal and morbid anatomy, both human and comparative, some of them being examples altogether new to the collection. And while our hearty thanks are due to all those who have presented specimens to the Society, one gentleman, Mr. Bland Sutton, is, I think, especially deserving of our thanks for his numerous contributions of unique illustrations of many interesting points in comparative dental pathology, which show the disastrous consequences that may occur to the lower animals when the subjects of accident or disease.

It has been suggested that if a few of the specimens lately acquired by the Society were exhibited and briefly commented upon, it might prove not uninteresting to the meeting, and that members might be stimulated to acquire an increased number of specimens for presentation to the Society's collection.

In the skull and mandible of a female Dugong (*Hallicore Dugong*) the Society has obtained a most valuable acquisition, for it previously possessed but two incisors (male) and a solitary molar to illustrate the dental armature of this most curious creature.

In this specimen the permanent incisors (the deciduous ones being already shed) scarcely protrude through their bony sockets; they are solid throughout and gradually diminish in thickness from the base to an obtuse rugged point, whereas the male incisors are of the same diameter from base to apex, where they are obliquely bevelled to a sharp edge like the scalpriform incisors of a rodent. The base of the male incisor is hollow and contains the large mass of pulp necessary for the production of this tooth of persistent growth; the pointed extremity of the tooth projects beyond the jaw, elsewhere it is covered in by solid bone. Not so, however, in the female; in her the base of the incisor is suddenly enlarged, bent obliquely outward, and presents a shallow excavation. It is remarkable that the wall of the socket over the expanded base of the incisor tooth in the female Dugong is always deficient, presenting a somewhat cribriform appearance, and marks a characteristic difference between the sexes.

There are no true permanent incisors in the lower jaw in either male or female. Of the twenty

molar teeth which is the full complement the creature possesses, the present specimen has but six; of these, however, the fourth and fifth molars are the most characteristic, and of these we are fortunate in possessing three of each.

The fourth molar is cylindrical in shape, slightly bent, the crown being flat or slightly excavated in the centre. The fifth molar is much larger than any of the others and later in appearance, so that by the time it comes into use some of the anterior molars have become absorbed and extruded from the jaw. No enamel enters into the structure of these teeth, the Dugong's molars consisting only of a central mass of dentine thickly encased by cementum.

Two interesting examples of dental disease occurring in Marsupials are afforded by the lower jaw of a Hypsiprymnus and half the skull and mandible of a Kangaroo.

In the former (Hypsiprymnus) the two lower incisors were broken during life, giving rise to two alveolar abscesses, and leading to such considerable necrosis that the right premolar (so peculiar and characteristic in this creature) has been destroyed and extruded.

In the Kangaroo extensive absorption of the alveolus has taken place, causing loss of the premolar and all the molars in each jaw except the last. The appearance forcibly reminds one of

that which is presented by a senile human jaw which has long ago parted with the teeth of its youth.

The skull of a Rabbit in which an ununited fracture of the lower jaw, with the formation of a false joint, has taken place, affords a good example of the mischief which may arise in creatures possessing teeth of persistent growth, when from accident their normal antagonism is not maintained. In this specimen the lower incisors are, from want of wear, excessively long, and the left upper incisor pierced the gum of the right lower jaw, causing periostitis and deposit of new bone where the sharp edge of the tooth came in contact. Some of the molars also, from non-approximation, have become excessively long and laterally deflected.

In the skull of a Lion affected with rickets we have obtained our first example of the king of the forest; but it is interesting pathologically rather than anatomically, for the bones are so immensely thickened, that although the teeth are very large, nothing like the whole of the crowns appear through the openings in the alveolus, and during life merely the points of the cusps pierced the mucous membrane which itself was enormously thickened. In consequence of the teeth never having been subject to wear, the sharp edges at the back of the incisors and on the margins of the canines are very accurately preserved. The specimen contains in the

upper jaw one incisor (the third), the canine and three premolars; the little true molar is missing. In the lower jaw the true molar, which is of course the carnassial tooth, is preserved.

In the skull and mandible of an African Wart-hog (*Phacochærus Æliana*) the Society has acquired another specimen of which no previous example existed in its collection.

Of all the hog tribe no member is more interesting in its dentition than the Phacochærus, for its third true molar is so large and peculiar that it is without rival for its size, compared to the jaw which contains it, in any living mammal with the single exception of the elephant.

This third true molar is laterally compressed, but greatly prolonged in an antero-posterior direction; the grinding surface of the tooth presents three parallel rows of tubercles, which are the worn extremities of a number of enamel cylinders surrounding a core of dentine, the whole being fused together by cementum. About eight of these cylinders appear in each row. The tooth is continued of the same size and shape without any differentiation into crown and fang, quite to the base of the jaw, where its formative pulp being preserved in an active condition continues to produce new tooth substance in compensation for that which is worn away until an advanced period of the animal's life.

If the third molar of Phacochærus be compared with that of the wild boar, with *Sus babirussa*, or with any other member of the hog tribe, the remarkable development of the tooth in the former creature will be at once apparent.

Additional interest is lent to the present specimen from the fact that an alveolar abscess has developed in the right side of the lower jaw, which has burrowed and pointed on its under surface. The bone is here rough and thickened, and cloacæ bear evidence that necrosis has supervened.

The class of Ungulata has lately been enriched by the acquisition of a skull and mandible of a young Hippopotamus. The incisors, two in number in each jaw, are but partly erupted, as are also the canines; in the upper jaw the second, third, and fourth premolars, and the first, second, and third true molars are *in situ* on the right side; the first premolar on both sides, and the second and third on the left being already shed; the fourth true molar on both sides is unerupted.

In the lower jaw the fourth premolar and the first, second, and third true molars are in place, the fourth true molar being still hidden in its bony crypt, while the three anterior premolars have been shed.

The Hippopotamus is becoming so scarce that I think the Society is be congratulated on acquiring so fine a specimen, which will serve as the comple-

ment of the adult Hippopotamus skull it has so long possessed.

A specimen of the so-called "Riggs' Disease" occurring in a monkey (*Cercopithecus lalandii*) is not only interesting from the evidence it bears that the lower animals as well as man are subject to this affection, but from the circumstance that the disease has attacked chiefly the buccal surface of the molar and premolar teeth in the upper and lower jaw; the lingual surface of the lower incisors, the position which in the human subject is the commonest for deposits of tartar being here comparatively free.

The last series of preparations to which I wish to draw the attention of the members consists of the crania and lower jaws of two adult Gorillas, and a series of bones of other parts of the Gorilla's skeleton. The skulls have been previously described; one, however, in addition to its anatomical interest, is also pathologically so from the fact that it bears evidence of previous injury which has caused extensive destruction of bone in the neighbourhood of the orbit, malar region, anterior nares, &c.

The bones of the skeleton have been arranged on a board side by side with their corresponding human ones, and it is very interesting to compare the relative proportions of the upper and lower limb in the two cases. In the gorilla the upper

limb is immensely larger than in man, as may be seen by comparing the enormous scapula and extremely long humerus, radius, and ulna of the gorilla with the much smaller human bones. In the lower limb the converse holds : here the human femur, tibia, and fibula are very much longer than those of the gorilla.

The sacrum in the gorilla is longer but narrower than its human prototype. The spinous processes of the vertebræ are in the gorilla remarkably long, and it possesses thirteen ribs and thirteen dorsal vertebræ to support them, instead of only twelve in the human subject.

Mr. Bennett having replied to several questions having reference to the specimens he had exhibited,

The President said he heartily thanked in the name of the Society all those who had contributed to the business of the evening, but especially Mr. Storer Bennett for his very interesting paper and exhibition of specimens. The Society was to be congratulated on having for its Curator one who took so lively and intelligent an interest in the collection committed to his charge; he wished Mr. Bennett success in his endeavours to improve it.

At the next meeting of the Society (June 7th) a paper, which he felt sure would be an interesting one, would be read by Mr. J. W. Groves, Fellow of the Royal Microscopical Society, on "Practical Microscopy in its relation to Odontology."

The Society then adjourned.

*** We have been asked to state, with reference to a remark of the President reported on p. 132 of the March number, that Dr. Geo. Field disclaims having had any share in the invention of the Cordless Dental Engine, the whole credit of which belongs to Messrs. Jamieson.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

June 7th, 1886.

GEORGE GREGSON, M.R.C.S. & L.D.S.Eng.,

Vice-President, in the Chair.

The Minutes of the previous meeting having been read and confirmed,

The following gentlemen signed the Obligation Book, and were formally admitted to membership, viz.:—

Messrs. C. M. Bayfield,
Murray Davis,
A. E. Clayton Woodhouse,
Geo. G. Campion.

The Librarian (Mr. Weiss) announced the following additions to the Library:—Official Year Book of Scientific and Learned Societies for 1886; the recent issues of the Scientific Proceedings and Transactions of the Royal Dublin Society; and some missing back numbers of the *Independent Practitioner*, making the file of that journal complete up to date.

The Curator (Mr. Storer Bennett) exhibited a model which had been presented to the Museum by Mr. Wilson, of Edinburgh, showing three bicuspids on each side of the lower jaw. The patient's dentition had at first been normal, but both the lower first molars having to be extracted, the space on the right side was soon occupied by a super-

numerary bicuspid, whilst on the left side the second molar came forward and closed the gap. Some years later this tooth also had to be extracted, and within a few months its place was taken by another extra bicuspid. The extracted molars were large and had well-developed roots. The patient had also on each side of the upper jaw a small supernumerary tooth situated between and outside of the first and second molars.

Dr. St. George Elliott showed several forms of Bunsen burner adapted for different dental purposes. One with a very short tube he used for annealing gold; another, with a detachable tube to facilitate cleaning, he used for waxing up; whilst a third could be used either as a Bunsen or as an ordinary burner, and was adapted for the blow-pipe.

Dr. Elliott also showed some nerve drills of his own make. He found it convenient to have three sizes of these, instead of the one usually sold. They were made with triangular corrugated points, and could be easily sharpened on a common oilstone.

He also showed, *apropos* of the discussion which had recently taken place in the dental journals with reference to the invention of the dental engine, the flexible drill made of coiled wire invented by Mr. Jas. Naysmith and the flexible cable supplied with the S.S. White engines, and pointed out that the former would be quite useless for dental purposes on account of the amount of "back-lash."

Lastly, Dr. Elliott invited the members to pay him a visit any day after 5 p.m. to inspect his arrangement for working his dental engine, lathes, &c., by means of a one-horse power Otto gas engine. The engine was placed at some distance from his operating room, the power being transmitted by means of a band running under the floor. It was easily controlled by means of a small lever pressed by the foot. The consumption of gas was about five cubic feet per hour, and the cost therefore about a farthing an hour.

Mr. Brunton (Leeds) showed an adaptation of the dental engine designed for the benefit of those who suffer from

"dentist's leg." The engine was of the Bonwill type, the arm from shoulder to elbow being 24 inches long; to this was attached an S.S. White cable. The engine being placed at the back of the operating chair, the cable is brought round the left side of the patient. The operator could sit at his work and drive with either right or left foot at will.

He showed the syringe which he used for injecting cocaine before the extraction of molar or bicuspid teeth, and stated that for some two months past he had been using a solution of benzoate of cocaine, and found that it was quite free from the tendency to decomposition which was met with in other solutions of this alkaloid. He had used it in between forty and fifty cases, and had not yet met with any in which sickness or other unpleasant symptoms had occurred.

In reply to questions from Messrs. Storer Bennett and Walter Coffin, Mr. Brunton replied that the solution of benzoate of cocaine seemed to be perfectly stable and capable of being kept unchanged for an indefinite time. Mr. Branson, the chemist, of Leeds, who had submitted it to various tests, had so assured him, and his own experience went to confirm the truth of the statement. As to the amount, he had several times injected from $2\frac{1}{2}$ grains to 3 grains without any unpleasant results following, and in one case he had injected as much as 9 grains at one sitting and extracted ten teeth. This patient was much addicted to alcohol, which might possibly have rendered him less susceptible to the influence of cocaine. He found that the local effect of the injection usually passed off in about ten minutes.

Mr. Brunton then showed a clamp and matrix which he had made and used in 1871, and had since exhibited at some of the meetings of the British Dental Association. It was identical with one figured in the *Cosmos* for May as something new. Finding, however, that its range of usefulness was limited, he constructed a matrix with the ends bent back, and which was held in position by an ordinary molar rubber dam clamp. This was shown at the Leeds and Plymouth meetings of the British Dental Association, and figured in a paper by Mr. Ladmore which appeared in the Journal of the

Association for June. Mr. Brunton handed round specimens of this matrix and of two others, also described in Mr. Ladmore's paper, one of which was secured on the tooth by means of a through bar, which was tightened by means of a key.

Mr. W. E. Harding, of Shrewsbury, exhibited and presented to the Museum the calcified but necrosed crowns of a right upper second bicuspid and first permanent molar, which he had removed from the mouth of a boy aged five-and-a-half years. The necrosis was the result of a chronic abscess connected with the deciduous molar which had been extracted by a medical man six months before Mr. Harding saw the case, but only after the abscess had been discharging some twelve months. The case showed the injury which might be caused to the undeveloped permanent teeth by abscess connected with the deciduous teeth.

Mr. Hunt (Yeovil) showed models of the upper jaw of a boy, aged sixteen, who had consulted him some time since on account of his central incisors, which were very large and a great disfigurement. He wished to have them extracted and replaced by substitutes, but Mr. Hunt dissuaded him. Subsequently one of them became carious and painful; it was extracted by a medical practitioner, and a short time afterwards a very good well-shaped central appeared in its place. Mr. Hunt then removed its fellow, in the hope that the same result might follow.

He was sorry he had not been present at the previous meeting when the subject of Cocaine was brought forward, but as it had been referred to again that evening by Mr. Brunton, he would briefly give his experience. He had used it pretty extensively by injection since November, and with very satisfactory results; but in order to get satisfactory results certain points must be attended to. Owing to the density of the gum tissue, it was not very easy to inject the solution properly; the instrument must be inserted deeply, the solution injected slowly, and the needle left in the wound for a short time. If removed at once a considerable portion

of the solution would escape by the puncture. Occasionally it would find its way into a fistulous track and escape in that way, or, in the lower jaw, if the needle was not inserted quite vertically, it might transfix the gum, and the solution would be injected into the floor of the mouth. In such cases the absence of the usual resistance when the fluid was injected would make the operator suspect something wrong. Excluding such accidents as these, he found that he obtained very definite and satisfactory results. Ordinarily he found one grain sufficient; in only three cases had he found it necessary to exceed this amount, and he had never used more than a grain and a half, but he had not yet been called upon to operate on a bibulous patient.

The SECRETARY showed a geminated right upper lateral and supernumerary tooth, extracted from the mouth of a boy eight years of age by Mr. J. B. Bridgman, of Norwich. It occupied the space between the permanent central and first temporary molar, and the permanent lateral was just appearing behind it. Mr. Bridgman presented the specimen to the Museum.

MR. HEPBURN showed a specimen of osseous union of two molar teeth sent by Mr. Tod, of Brighton, but without any particulars respecting the case.

The CHAIRMAN then called upon Mr. J. W. Groves to read the paper of the evening on "Practical Microscopy in its application to Odontology."

Practical Microscopy in relation to Odontology.

By J. W. Groves, F.R.M.S., &c.

Mr. Chairman and Gentlemen,

Some time since your President, whose absence to-night I much deplore, asked me to give you a demonstration in the method of making histological preparations of teeth, to which I gladly acceded, although I have had but little experience in this particular branch of histology, as the mode of preparing one tissue is almost identical with that used for others. The order in which I propose to treat of the various processes is that in which they are used, viz.: fixing, hardening, cutting, staining, clearing, and mounting.

So soon as a tissue is removed from the body changes commence; therefore it is important that the material should be as fresh as possible, and that it should at once be placed into a fluid which will *fix* it. The best fluids to use for this purpose are—

(1) *Osmic acid* ($\frac{1}{4}$ to 1 per cent. solution in water). This has but little penetrating power, therefore the material to be acted upon should be in slices of not more than $\frac{1}{4}$ inch thick.

(2) *Osmic acid*, 10 parts; *chromic acid*, 25 parts; to *water*, 100 parts.

(3) *Picric acid* (saturated solution in water). This is often spoken of as a hardening agent; it is more useful as a fixing agent, for which it is most excellent.

(4) *Silver nitrate* ($\frac{1}{2}$ to 3 per cent.). This is useful for fixing and also for staining. This also has but little penetrating power.

(5) *Gold chloride* ($\frac{1}{2}$ to 1 per cent.). This, though a splendid fixer, is more used as a stain, especially for nerve tissues.

(6) *Chromic acid* ($\frac{1}{6}$ per cent. in methylated alcohol) is at once a fixing and a hardening agent.

(7) *Neutral chromate of ammonia* (5 per cent. solution in water).

(8) *Picro-sulphuric acid*, made by adding 2 per cent. of sulphuric acid to a saturated solution of picric acid in water. This must only be used if there is but very little lime present, or an insoluble precipitate will be produced.

Tissues cannot be cut in a fresh condition if thin sections are desired; they must therefore be subjected to a process of hardening, for which purpose the most generally useful reagent is alcohol. In order to insure the tissue being equally hardened throughout, the pieces should be small

and the fluid (which should be changed frequently) must be used at first dilute, then stronger and stronger until the full strength is reached.

The following is a list of the more useful *hardening agents*:—

(1) *Alcohol.*

(2) *Chromic acid* ($\frac{1}{4}$ per cent.).

(3) *Bichromate of potash* (2 per cent. solution in water).

(4) *Bichromate of ammonia* (2 per cent. solution in water). The bichromates penetrate better than chromic acid; they are therefore generally preferable to it, and when chromic acid is used it is well to place the tissue at first into one of these fluids for a short time.

(5) *Muller's fluid*, composed of—

Bichromate of potash, 2 to $2\frac{1}{2}$ parts;
Sulphate of soda, $\frac{1}{2}$ part;
Water, 100 parts.

This is specially useful for nervous tissues.

As soft tissues require to be hardened, so all hard—*i.e.*, calcareous—material has to be softened, before sections can be made except by grinding. Decalcification is effected by immersion in one of the following fluids:—

(1) *Picric acid* (saturated solution).

(2) *Chromic acid* ($\frac{1}{4}$ part); *nitric acid* ($\frac{1}{2}$ part); *water* (100 parts).

(3) *Picro-nitric acid*, made of—

Water, 100 parts;

Nitric acid (25 per cent. of N_2O_5), 5 parts;

Picric acid to saturation.

N.B.—This can be used when only very little lime is present.

It is necessary in all cases to have a considerable bulk of the hardening fluid compared with the pieces of tissue, and to change it every day for the first four or five days.

The material being now ready for sectioning, it is necessary to consider the various embedding media:—

(1) *Paraffin and lard.*

(2) *Paraffin and vasalin.*

(3) *Paraffin and chloroform.*

(4) *Wax and olive oil.*

(5) *Gum mucilage + a few drops of camphorated spirit.*

(6) *Gum mucilage + syrup + bichloride of mercury.*

(7) *Celloidin in alcohol* (absolute) *and ether.*

How to use these will be best described when treating of some of the section-cutting machines now in use.

The sections may now be stained, or, if more convenient, may be placed in a preservative solution until wanted; for this purpose the following may be used:—

(1) *Alcohol* (2 parts), *water* (1 part).
(2) *Glycerine.*
(3) *Gum arabic* + *syrup* + *mercuric chloride*, $\frac{1}{5}$ per cent.
(4) *Bichromate of potash*, 1 per cent.

The object to be obtained by staining is the rendering more distinct certain tissues or particular portions of cells. For staining nuclei of cells the following stains are of especial value :—

(1) *Logwood* or *hæmatoxylin.*
  (*a*) *Hæmatoxylin extract* (saturated solution in *alcohol*).
  (*b*) *Potash alum* (saturated solution in *water*).

Add a few drops of (*a*) to (*b*), and when mixed add a few crystals of *phenol.*

(2) *Borax carmine.*
  (*a*) Carmine.
  (*b*) Borax.
  (*c*) Distilled water.

Place (*a*) and (*b*) dry in a mortar and dissolve in water. Allow to stand for twenty-four hours and then decant. This will stain in mass—*i.e.*, will penetrate well.

The next two stains, besides tingeing nuclei, also colour other parts of the sections.

(3) *Anilins* (dissolved in water).
(4) *Anilins* (dissolved in alcohol).
(5) *Osmic acid*, 1 per cent.

(6) *Osmic acid*, 10; *chromic acid*, 25; *water*, 100 parts.

(5) and (6) are of marked value for selecting fat, which becomes coloured grey or black.

(7) *Silver nitrate*, $\frac{1}{2}$ to 3 per cent.

(8) *Gold chloride*, $\frac{1}{2}$ to 1 per cent.

(7) colours intercellular and interfibrillar cement substance brown.

(8) produces a distinct violet tint in nerves, while both (7) and (8) prevent any considerable shrinking or other alteration.

After staining, the next step is to wash the sections, and the fluid to be used for this purpose must depend upon the solvent of the stain which has been employed: thus, if an aqueous stain has been used, the sections must be placed in water; whereas if it were an alcoholic stain, then the washing fluid must also be alcohol. The next steps to be taken must depend on the nature of the medium which it is intended to employ as a mountant. Of *mounting media* these are among the best:—

(1) *Glycerine.*

(2) *Glycerine jelly.*

(3) *Farrant's medium*—

Gum arabic, ʒiv.

Water, ʒiv.

Glycerine, ʒij.

(4) or—

Gum arabic, 5 parts;
Water, 5 parts;
to which are added after twelve hours—
Glycerine, 5 parts;
Phenol (·05 part in water), 10 parts.

(5) *Canada balsam* (pure).
(6) *Canada balsam dissolved in chloroform.*
(7) *Canada balsam dissolved in benzol.*
(8) *Canada balsam dissolved in xylol.*
(9) *Dammar lac.*

After washing the sections they may be mounted at once in either (2), (3), or (4), but if it be desired to put them up in (1) it is best to put them first into weak glycerine and to transfer them later on to stronger glycerine, or to place them in a watch-glass full of weak glycerine, and to leave them there with a cover so that by evaporation the fluid may become gradually stronger, when they may be placed on a slide, a cover-glass placed over them, be cemented, &c.

If, however, they are to be mounted in either of the preparations of *balsam*, they must, after washing, be thoroughly dehydrated with alcohol, then clarified with one of the *clearing* agents, and from that be transferred to the balsam or dammar.

Of *clearing agents* the following may be enumerated:—

(1) *Oil of cloves.*

(2) *Oil of cedar.*
(3) *Turpentine and creosote* (4 to 1).
(4) *Turpentine and phenol* (4 to 1).
(5) *Absolute alcohol.*
(6) *Alcohol and phenol* (concentrated).
(7) *Oil of bergamot.*
(8) *Oil of sandal wood.*

Of the clearing agents and preparations of balsam, each has some special value: thus, if it be desired to stain with an anilin the clearing agent should be cedar oil, and the balsam should be dissolved in xylol; whereas if the material had been embedded in celloidin, then the clearing agent should be oil of bergamot.

All specimens mounted in a fluid, or in glycerine jelly, or Farrant's Medium, must have the edges of the cover glasses cemented with one of the following cements—

(1) *Dammar varnish.*
(2) *Balsam in benzol.*
(3) *Zinc cement.*
(4) *R. Miller's caoutchouc cement.*
(5) *Gelatin and bichromate of potash.*
(6) *Hollis' glue.*

The order of procedure to mount a specimen in glycerine is—

(1) To fix.
(2) „ harden.
(3) „ cut.

(4) To stain.
(5) „ wash.
(6) „ place in glycerine.
(7) „ transfer to stronger glycerine.
(8) „ cover.
(9) „ cement.
(10) „ label.
(11) „ keep on the flat.

To mount in balsam the steps are—

(1) To fix.
(2) „ harden.
(3) „ cut.
(4) „ stain.
(5) „ wash.
(6) „ dehydrate.
(7) „ clear.
(8) „ mount in balsam.
(9) „ label.
(10) „ keep on the flat.

With regard to the machines used for cutting sections, these may be divided into those in which the material is raised, and those where the razor is depressed for each section; or they may be grouped into freezing microtomes, and those in which material which has been hardened by other means may be cut. To prepare material for a freezing microtome the hardening agent must first be removed by maceration in water for about twenty-four hours, then for a similar period it must be

immersed in *gum mucilage* to which a little spirit of camphor has been added, the object of the spirit being to prevent the gum freezing in a crystalline form, and of the camphor to avoid the growth of fungi in the solution; the material is then ready for cutting. The gum, syrup, and bichloride of mercury may be used in exactly the same way.

When the tissue to be cut consists of very loose structure it is best to not merely embed, but to macerate in either *celloidin* dissolved in alcohol and ether, or in *paraffin* dissolved in chloroform. In the former case the material must be transferred from alcohol to a mixture of alcohol and ether, then to chloroform, from which it must be introduced into a thin solution of paraffin in chloroform, from which it may be passed into a warm and stronger solution, in which it should remain for a day or two, so that the whole of the tissues may become infiltrated with the embedding mixture. When celloidin is to be used the material should be passed from the alcohol and ether to a thin solution of celloidin in the same fluid, placed in a pill-box, and here it should remain with a bell glass over it until a thin scum forms on the surface; the box with its contents must then be placed in about 80 per cent. alcohol, when the whole mass assumes a cheesy consistence and is then ready for cutting. For embedding

material to be cut by hand, either of the embedding mixtures numbered (1), (2), (3), (4) may be employed.

Mr. Groves then gave a demonstration of the methods of cutting and putting up sections for microscopic examination, and referred the Fellows for further information to "The Microtomist's Vade Mecum," by Bolles Lee; "Practical Histology," by Purser; and to "Bacteriology," by Crookshank.

Discussion.

Mr. Arthur Underwood said he was sorry to see that there was so little time left before the close of the meeting that it was useless to attempt to discuss the paper. He would, therefore, only mention that he had placed under the microscope on the table a specimen which presented three different points of interest. First it was a marked example of failure in mounting with glycerine jelly, though fortunately the air bubbles did not obscure the principal feature of the section. Secondly, it was a good specimen of staining with chloride of gold. And lastly, it showed an unusually large interglobular space, the largest he had as yet happened to meet with.

Dr. Geo. Cunningham said he was surprised that Mr. Groves had not mentioned amongst the decalcifying agents a solution which had been recommended by Mr. Charters White in the paper which he read at the meeting of the British Dental Association at Cambridge, and which certainly gave very satisfactory results. It consisted of a saturated solution of alum with half a drachm of hydrochloric acid added to each fluid ounce.

It appeared to him that the prevailing methods of staining and mounting must be influenced by fashion; for whilst he found Mr. Groves in London recommending logwood for staining, he had found picro-carmine in general use at Edinburgh. The latter seemed to have many advantages and to be as easy of application as logwood.

He would take the opportunity of calling the attention of members to the fact that a new edition of Professor Klein's work on Micro-organisms had recently been published and would be found very interesting reading. There were still several important questions to be solved in connection with micrococci and bacilli. Mr. Charles Tomes had recently referred to one of these, when he requested members who might meet with dead teeth the pulps of which had not been

exposed in any way, to examine them with the view of ascertaining whether or not any of these organisms were present. And this was really a very simple matter. It was only necessary to open the pulp cavity, preferably under rubber-dam, to touch the remains of the pulp with a platinum point previously sterilized by heating it in the flame of a spirit lamp, to draw this across a clean cover-glass, placing another cover-glass over it and squeezing the two together in order to obtain as thin a layer as possible, and after separating them to dry by passing them through the flame of the spirit lamp. In this condition they might safely be left until a convenient opportunity offered for staining and mounting the specimens.

Mr. Groves replied very briefly. He was sorry to have to confess that he had not seen Mr. White's paper, and did not know of the solution. Picro-carmine was a very useful stain, but it had the disadvantage of penetrating very slowly; thus a section must be left in picro-carmine for twenty-four hours, whilst a few minutes sufficed with logwood.

The Chairman said it only remained for him to thank Mr. Groves in the name of the Society for his interesting paper, which contained a great deal of information of a very useful and practical nature. He also thanked Dr. Elliott, Mr. Brunton, Mr. Harding, Mr. Hunt, and the other contributors of cases and specimens.

The next meeting would take place on November 1st, when he hoped that Dr. Dudley Buxton would be ready with the concluding portion of his paper on the Physiological Action of Nitrous Oxide.

The Society then adjourned.

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